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A SKETCH OF THE HISTORY OF FERN CLASSIFICATION

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During the two centuries since the beginnings of formal classification the group of ferns has grown from less than 200 to approximately 10,000 species. Against this background of ever-increasing knowledge, augmented later by the theory of evolution, the classification of ferns has developed. With the considerable present-day interest in the ferns from the viewpoints of paleobotany, anatomy, cytology and morphogenesis, as well as systematics itself, it is certainly desirable to understand our present classification, its basis and its problems. While these might be stated categorically, they can only be understood in the light of their history. Although J. E. Smith (1810), John Smith (1875) and Jean-Édouard Bommer (1867) have, among others, published good reviews of the earlier fern classifications, it will be desirable to follow these again as well as the more recent developments. One cannot, in a brief review, mention all of the authors who have contributed materially to our present classification of ferns nor is it even possible to do justice to the few selected. Rather, I will trace the more important trends in classification and mention some of the most significant authors and their works by way of illustration.

On the authority of Sir J. E. Smith we may pass by the seventeenth and early eighteenth century authors, for as he has said (Smith, 1793, p. 401¹): "The Genera of Ferns, entirely neglected by the older botanists, and but slightly or superficially touched upon by systematic writers of the last century, were first attempted to be reduced to fixed principles by Linnaeus." The shape of the sorus and its position on the leaf afforded Linnaeus (1753, 1754) the primary characters for his genera. He recognized 11 genera of Filicales² in his *Cryptogamia Filices* and about 175 species. This was a highly artificial arrangement, species of quite distant relation

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¹ In this and the next quotation the reference is to the original paper, but the quotation is from the English translation (1798).

² The works to be discussed differ considerably in their scope—some are complete, some omit one family, others omit several families. As a matter of convenience, the number of genera given for each classification is that of the Filicales as presently defined, i.e., the *Leptosporangiateae*. All authors include the largest family, the *Polypodiaceae*, *sens. lat.*, and the inclusion or omission of the smaller families does not greatly alter the comparative value of the numbers.

being placed together, yet it was a beginning and served a utilitarian purpose in placing newly described species until it was succeeded by a more natural system. It was not that Linnaeus' characters were at fault, for we still use them today, but rather that they alone are quite inadequate to establish natural genera.

Characters of the indusium were first used effectively by Sir James Edward Smith (1793) some 40 years after Linnaeus. Smith recognized 20 genera based on characters of the shape of the sorus, its position on the frond, the shape and placement of the indusium and the manner of its opening. He expressed his views on the importance of the indusium, particularly the manner of its opening, in these words (Smith, 1793, p. 405): "This circumstance no one has yet considered; yet it is undoubtedly of the greatest use in determining natural genera, being not only constant in every species, but in ferns whose habit and other particulars agree, it is always found to be similar." Smith's classification is also the first to be presented as a natural system. Since his time authors have basically agreed on the need for a natural system but beyond this there has been, as we shall see, much diversity of opinion. It would probably be difficult to improve on Smith's system so far as the species he knew are concerned. However, in retrospect we can see that he underestimated the group he was classifying by using only characters of the fruiting parts to define his genera.

The first handbook of ferns, by Olof Swartz (1806), treated 33 genera and something less than 700 species. Swartz used the same characters of the sorus and indusium as established by J. E. Smith, and his book represents the first fully elaborated treatment of Smith's system. In spite of the fact that many of Swartz's genera were large and unnatural, they were accepted until three decades later. In the interim new genera were described, but on the same basis as before. One of the most elaborate classifications following the Swartzian system was published by Niçaise Augustin Desvaux (1827). He recognized 66 genera of Filicales, an increased number due to a more detailed analysis of characters of the indusium and of the disposition of the sporangia.

Actually, the naturalness of Smith's system was in part passé even before Swartz's elaboration, and it certainly was entirely so by the time of Desvaux's classification. However, the recognition of additional genera based on increased study of the sorus and indusium did make the latter system more natural than Swartz's. It is now fully apparent that new species were being added so rapidly that most genera could not be maintained as reasonably natural groups without splitting them on the basis of new characters. Perhaps one reason that this was so long delayed was that the known ferns could all be conveniently placed into genera based solely on the characters of the sorus and indusium. However usable, this system was finally challenged since too many species, diverse in other characters, were all mechanically placed in one genus.

The notable revision of fern genera by Karel (Carolo) Boriwog Presl (1836) introduced new, essentially modern, principles of classification. He used vegetative characters as well as those of the fructification, placing special emphasis

upon the venation. In addition he used characters of habit, of the rhizome, position of the leaves, number of vascular bundles in the petiole, and the nature of the indument. He discussed and illustrated spore characters, although he did not make use of them in his classification. Presl recognized 117 genera in 1836 and added 59 more in his later publications (1843, 1845, 1852). That generic characters may be drawn from any part of the plant—their value being dependent upon their behavior and correlation with other characters—and that the vegetative organs may furnish characters of equal or even more importance than the fruiting organs became evident in the work of Presl. Although his system has been corrected in many ways his methods are still valid.

Presl must be given credit as the founder of modern pteridology in point of time, but actually this should be shared almost equally with John Smith who worked out a revision of genera independently. Smith (1841-1843), although differing on generic limits, employed essentially the same kind of characters as Presl, generally placing strong emphasis upon venation and vegetative characters. He recognized 138 genera of Filicales. The independent publication of two such similar classifications simultaneously would seem to emphasize that the time was ripe for the introduction of new principles.

The new approach to classification was hardly well founded, however, before it was effectively challenged from an authoritative position. Sir William Jackson Hooker, Director of the Royal Botanic Gardens, Kew, had provisionally accepted many of John Smith's and Presl's genera in his 'Genera Filicum' (Hooker & Bauer, 1838-1842). A few years later (Hooker, 1844-1864), he began publication of his monumental 'Species Filicum'; he comments in the introduction (Hooker, 1: xiv):

Increased study has, he must confess, strengthened his conviction that those Botanists, who have showed themselves peculiarly addicted to multiplying genera, have not always taken Nature for their guide, nor succeeded in eliciting a simple and tangible arrangement. . . . In these remarks Dr. Presl and Mr. John Smith are particularly alluded to.

Hooker recognized only 63 genera and based them on the classical characters of sorus and indusium. He did not deny the naturalness of many of Presl's and John Smith's genera and treated them as subgenera or sections. In his free use of these subgeneric categories—89 of them—Hooker probably strove for a middle course between the large unnatural established genera and the smaller, relatively natural ones of Presl and John Smith. As we see it now, this was not a particularly successful attempt since in the large genera the section became of equal importance to the genus itself.

There seem to be two basic differences in the viewpoints of Hooker and those of Presl and Smith. Hooker required that genera be based on characters of the fruiting parts (vegetative characters were of subgeneric or sectional value), and he emphasized utility; Presl and Smith, using all characters, recognized a major natural group of species as a genus and emphasized naturalness. Perhaps in his day Hooker's was philosophically the sounder view, supported strongly by ex-

perience in the classification of the flowering plants. Or perhaps Presl and John Smith had an insight into the ferns that enabled them to see the limitations imposed in this particular group by the fruiting structures. In all events, for the next half-century Hooker's system dominated pteridology and prolonged the life of the Swartzian system to nearly a full 100 years. It was not effectively opposed until nearly the 20th century.

Probably the most elaborate 'Genera Filicum' was written by Antoine Laurent Apollinaire Fée (1850-52). Fée followed the Preslian school but used an even greater variety of characters. He recognized 181 genera with an additional seven of doubtful status. The fine lithographs of J. A. Villemin present details of the venation, sorus, indusium, indument, sporangium and spores. In addition to vegetative characters, Fée sought to find new characters in the fruiting structures and introduced the number of the cells of the annulus of the sporangium. Fée compared the value of this character in the ferns to that of the peristome in the classification of the mosses although subsequent study has hardly confirmed his optimism. In spite of his detailed study of this character it was not used again in a major classification until Copeland's recent 'Genera Filicum.'

Having finished his 'Species Filicum' in 1864, Hooker commenced a synoptical handbook of the species of ferns in order to place the more important information of his previous publication before the public in a more convenient form. His 'Synopsis Filicum' was completed after his death by John Gilbert Baker (Hooker & Baker, 1865-1868). The treatment of genera is almost identical to that of the 'Species Filicum' and it remained the same in the second edition of 1874. The importance of the 'Synopsis Filicum' is that it was the first handbook of ferns since that of Swartz in 1806, and its great utility was a very important factor in carrying to general acceptance the Hookerian System. Such a synopsis of species was never published by the followers of Presl.

Although John Smith was preceded by Presl in laying the foundations of the modern system, he fully established his own position by his later publication, the 'Historia Filicum' (Smith, 1875). This publication not only presented his own matured views but also integrated the numerous genera of Presl and Fée. He recognized 212 genera of Filicales, three times as many as the 'Synopsis Filicum' of 1874. Smith was the founder and curator of the living fern collection at Kew and under his care it became one of the most notable ever assembled. He had an intimate knowledge of his plants, and this is reflected strongly in his classification. Smith's views, however well founded upon observation of the living plant, were nevertheless largely ignored until the twentieth century.

The first breach in the dominance of the Hookerian system was made by Hermann Christ (1897), and it was effectively widened by Ludwig Diels in his treatment in the 'Natürlichen Pflanzenfamilien' (1898-1900). Although Christ recognized only 92 genera he did emphasize vegetative characters for genera and this basis was enlarged upon by Diels. The latter author recognized 130 genera (including Sadebeck's treatment of Hymenophyllaceae). Diels thus had almost twice as many genera as the 'Synopsis Filicum'. He gave new impetus to classifica-

tion, particularly phyletic classification which was in its initial stages. Diels attempted a phyletic presentation based on characters of the sorus and indusium. Such a basis has not actually been discredited, but in general it has been slighted by the present emphasis upon vegetative characters.

The work of Diels also stands as a landmark for the modern usage of the family as a formal category. Previous authors rarely used the family category; the major groups of genera or tribes were usually called orders or suborders. Robert Brown (1810) recognized some of the essential differences of the sporangia that were to form the primary characters for the fern families. Carl Frederick Phillip de Martius (1828–1834) listed seven major groups of his Filices, and they generally correspond closely to our modern families in form of name, characters and content but he did not designate their category. A year later (Martius, 1835) he changed this classification somewhat, recognizing five orders of ferns and under the order Filices he had seven families. These groups are without description and by comparison with the classification of the angiosperms it is clear that his category order corresponded to our modern family. Georg Mettenius (1856) brought previous usage even closer to our own, with the exception that again he used the category order for the equivalent of our family. The sporangial characters and content of his orders are very similar to those of the families of Diels. As an indication of the instability in the use of the higher categories it may be noted that while Martius had families as subdivisions of his orders, Mettenius reversed this and divided the family Filices into eight orders. Christ (1897) had major groups very similar to those of Diels but did not designate their rank. Thus although the characters of the annulus and capsule had rather early been established, our families in their modern sense and usage begin with Diels.

There was a period of great activity during the next two decades in which new genera were described and old ones revived, and, perhaps of more importance, a basis of fact was laid for a real phyletic system of classification. The studies of Karl Eberhard Ritter von Goebel, summarized in his 'Organographie' (1898–1901, 1918) and of F. O. Bower (1894–1904, 1910–1923) on the growth, development, anatomy and morphology of the fern plant, and particularly those of Sir Albert Charles Seward (1900, 1910) and Dukinfield Henry Scott (1908) on fossil ferns made a phyletic classification possible. At least, with such a broad basis of comparison, certain relations could be fairly well deduced, although others remained as largely speculative.

The first really phyletic classification was by Frederick Orpen Bower (1923–1928) who developed his phylogeny on a broad basis of anatomical, morphological, and developmental characters. He recognized twelve families of Filicales and six lines of evolution in the Polypodiaceae. Primarily due to the consideration of the difference between the marginal and superficial sorus as fundamental, these lines within the Polypodiaceae were treated as three quite independent developments. This proposal of polyphyletic for the traditional fern family is the most striking and most debated aspect of his treatment. Bower's elaborate three-volume work

is the best documented account of fern phylogeny. However, his interests were not in formal taxonomy and although he recognized separate groups of the Polypodiaceae he did not propose a system to accommodate them.

Edwin Bingham Copeland (1929) was the first systematist to deal with the problem of recognizing the polyphyletic origin of the Polypodiaceae in a formal classification. He points out that there are two alternatives, (1), to raise each phyletic line to the rank of family, or (2), define the Polypodiaceae so as to include the older types and make it monophyletic. He considers neither as free of objection but adopted the latter course. His Polypodiaceae includes the Plagiogyriaceae, Cyatheaceae, Dicksoniaceae, Matoniaceae and Dipteridaceae of Bower. Such a group, according to Bower's views, however, would not be monophyletic. A unique feature of Copeland's treatment is his interesting system of numbering the genera in such a manner as to show their place in the phyletic tree or bush. This or a similar system might be considered as a possible means of circumventing the difficulty of expressing phylogeny in a necessarily linear presentation of the genera in book form.

Carl Christensen (1938) published the first complete taxonomic synopsis that took into account the modern advances. He recognized twelve families of Filicales and about 230 genera which were based on a wide variety of characters. He divided the Polypodiaceae into fifteen subfamilies although he states in the text that perhaps it would be better to treat them as families. Within each family or subfamily the genera are arranged in a generally phyletic sequence. In considering the subfamilies Christensen agrees with Copeland, and disagrees with Bower in stating (*loc. cit.*, p. 534): "They are not very closely related to each other but probably separate branches from an ancient common stock. . . ." As a matter of opinion and of convenience he does not include the closely related families within the Polypodiaceae, as Copeland did, but rather defines the family on the basis of the sporangium.

Three recent studies have added new views on the phyletic classification of the fern families. Ren-Chang Ching (1940) divided the Polypodiaceae into 32 families which were grouped into seven distinct lines of evolution. In general, these are the same lines that Copeland later recognized as families. Ching's work is poorly, if at all, documented in so far as justification of his recognition of the numerous families is concerned. It can hardly be given serious consideration unless we are quite ready to reject the present usage of the family category. Frederick Garrett Dickason (1946) inclines to question the full validity of many of Bower's tenets, and in particular he points out possible weaknesses in the derivation of the polypodiaceous sporangium from several different sources and the derivation of the marginal and superficial Polypodiaceae from similar marginal and superficial Simplicies. Dickason accepts the numerous families of Ching but implies that the main groups of families arose more or less simultaneously from a common basic plexus. Richard Eric Holttum (1947) also attacks the validity of certain of Bower's expressed relationships and presents a revised classification of

the Polypodiaceae. He recognizes five families, the largest, Dennstaedtiaceae, containing eleven subfamilies. This family, although natural, he admits as undefinable. Especially notable in Holttum's work is the use of characters of the type of cutting and branching pattern of the leaf and also of his essentially complete denial of the basic difference of the superficial and the marginal sori, genera of both kinds being placed in the same family.

The latest phyletic classification is by Copeland (1947) who now essentially accepts the polyphyletic of the Polypodiaceae as envisioned by Bower. He recognizes three major independent lines and classifies these in eight families. Eleven additional families of Filicales bring the total to nineteen. He has 299 genera based on a wide variety of characters and these correspond in principle, as do those of Christensen, to the genera of Presl, Fée and John Smith. In adopting separate families for the lines of evolution of the Polypodiaceae Copeland has lost definition of his groups. In fact, he freely admits Pteridaceae and Aspidiaceae as natural but undefinable. This is a consequence of his philosophical principle that a family or genus must be natural and only secondarily should be convenient. This treatment brings to the fore, perhaps more forcibly than ever before, the conflict between naturalness and utility in classification.

The next major system will necessarily be most concerned with two issues. One is the phylogeny of the Polypodiaceae, *sens. lat.*, involving primarily the nature and origin of the sporangium and the phyletic relation between marginal and superficial sori. The other is the conflict between utility and naturalness mentioned above. The first issue must still be worked out since it cannot be now considered that the phylogeny of the Polypodiaceae is sufficiently known. As to the second issue, it is now evident, at least in the ferns, that a single classification cannot have a maximum of both utility and naturalness. Bower has expressed what is probably an accurate estimate of the relation of the two types of classification (Bower, 1928, vol. 3, p. 39):

"A complete artificial classification is always possible and is indeed necessary for floristic use. A complete phyletic classification will only become possible with complete knowledge of the descent of the organisms classified. The second cannot replace the first under present conditions, owing to the imperfection of present knowledge. But it can lead to a correction and amendment of classification for floristic use, so as to make it run ever more nearly along lines of probable evolution."

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A STUDY OF THE ARBORESCENT LYCOPODS OF SOUTHEASTERN KANSAS

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Studies of the anatomy of North American species of *Lepidodendron* have been largely restricted to a few recently described species. These are *L. novalbaniense* (Read, '36) and *L. boylensis* (Read and Campbell, '39), *L. Johnsonii* (Arnold, '40), *L. scleroticum* (Pannell, '42), and *L. ballii* and *L. wilsonii* (Evers, '51). *L. vasculare* has been reported by Graham ('35) and others, but this well-known European species has not been studied in detail. *L. Johnsonii* and *L. scleroticum* represent the best examples of critical studies of this genus by American workers.

The present study is based on several scores of *Lepidodendron* specimens collected from the open pit of the Pittsburg and Midway Coal Company located four miles south of West Mineral, Kansas. The abundance of these arborescent lycopod stems indicates that they were a dominant element in the Pennsylvanian flora of that area. The diversity of branch orders represented is far greater than in any other coal ball deposit that we have yet encountered, and consequently the identification of the species has been made with considerable difficulty. For reasons which are pointed out below, three distinct species appear to be represented.

LEPIDODENDRON *kansanum* Felix, sp. nov.

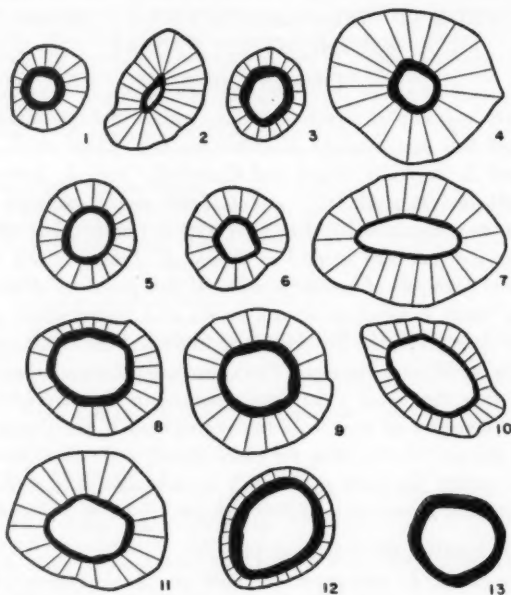
The description of *L. kansanum* is based on about twenty of the better-preserved stems although several dozen others were found which supplemented the study. While the most striking feature of *L. kansanum* is the large size of the central cylinder, there is great variation in the ratio of the diameter of the primary body to the thickness of the primary and secondary wood. Text-figs. 1-13 and figs. 5 and 6 (pl. 25) show this variation in several of the best-preserved specimens. Table I gives the dimensional relationships of the steles used in the description.

All the specimens are siphonostelic, the diameter of the pith ranging from 10 mm. (text-fig. 1) to 40 mm. (text-fig. 13). Of particular interest is the primary body-secondary wood ratios. For example, the stele shown in text-fig. 1 has a pith 10 mm. in diameter with a conspicuous (16 mm. thick) development of secondary wood, while that shown in text-fig. 13 has a pith 40 mm. in diameter, great thickness of primary wood, and but little secondary xylem. The extra vascular tissues are frequently lacking or poorly preserved in these large specimens, but as much as 63 mm. of periderm and cortical tissue are found accompanying one large stele of 73 mm. in diameter.

The Pith.—

A pith is present in every specimen and measures from 10 to 40 mm. in diameter, with excellent preservation in several steles. It consists of thin-walled cells arranged in longitudinal series; the end walls are transverse although an occasional specimen was observed in which they were irregular as if division were still occur-

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Diagrammatic transverse sections of the steles of several well-preserved plants of *L. kansanum*. Solid black represents primary xylem; radiating lines, secondary xylem; and central area, pith.

Fig. 1, WCB 772; fig. 2, WCB 706; fig. 3, WCB 778; fig. 4, WCB 821; fig. 5, WCB 761; fig. 6, WCB 767; fig. 7, WCB 776; fig. 8, WCB 771; fig. 9, WCB 765; fig. 10, WCB 800; fig. 11, WCB 769; fig. 12, WCB 704; fig. 13, WCB 824. $\times \frac{1}{4}$.

ring at the time of deposition. However, these apparent divisions were not seen frequently enough to warrant a division of the pith into more than one zone such as occurs in *L. Johnsonii*. There is no evidence of tracheidal cells in the pith, the transition to the xylem being abrupt. The pith cells are nearly isodiametric and measure 162–296 μ in diameter and 133–355 μ in length.

The Primary Xylem.—

The apices of the corona are the longitudinal projections of the protoxylem (pl. 25, fig. 1) and are about 700 μ apart around the periphery of the primary stele. The course followed by the protoxylem ridges has been the subject of some debate. Seward ('10) stated that they formed vertical bands, but earlier Bertrand had described the arrangement as a lattice work. Arnold ('40) dealt at some length on the course of the ridges. It appeared to him that they divided at intervals of several centimeters, at which space the traces departed. Then from the point of division the ridges continued a parallel course as reparatory strands. Unfortunately, he was handicapped in his determination by poor preservation in the contact zone of primary and secondary wood.

TABLE I
DIMENSIONAL RELATIONSHIPS BETWEEN THE PITH, PRIMARY XYLEM, AND
SECONDARY XYLEM IN THE VARIOUS STELES

Stem No.	Diameter of pith (mm.)	Diameter of primary stele (mm.)	Total diameter of stele (mm.)	Width of X ₁ (mm.)	Width of X ₂ (mm.)
772	10.0	19.5	51.5	4.75	16.0
706	12.0	18.0	66.0	3.0	24.0
778	17.5	27.0	43.0	4.75	8.0
821	20.0	28.0	92.0	4.0	32.0
761	24.0	29.0	63.0	2.5	17.0
767	24.0	29.0	61.0	2.5	16.0
776	28.0	32.0	76.0	2.0	22.0
771	33.0	42.5	75.5	4.75	16.5
765	34.0	44.0	85.0	5.0	20.5
800	34.0	42.0	62.0	4.0	10.0
769	35.0	40.0	80.0	2.5	20.0
704	39.0	49.5	68.0	5.25	6.0
824	40.0	50.0	50.970	5.0	0.970

In tangential sections of *L. kansanum* as many as four adjacent protoxylem ridges have been traced for a distance of 33 mm., during which space they maintain a parallel, vertical course without division or joining (fig. 23). However, other sections have revealed occasional division of the strands, and in one instance the definite departure of a leaf trace from this point of division has been confirmed.

The protoxylem cells are small, with spiral and reticulate wall thickenings. The metaxylem cells increase in size toward the center, attaining a maximum diameter of 300 μ . They average 22 mm. in length with tapered ends, although occasional cells have been measured up to 31 mm.

Both primary and secondary tracheid walls present the distinctive "Williamson's striations" observed previously in several species. There are several interpretations of their morphology, and Pannell ('42) has treated these in detail. Additional evidence that these threads are secondary in origin has been offered recently by Wesley and Kuyper ('51), who have examined the tracheids of *L. vasculare* with the aid of an electron microscope.

The Intraxylary Zone.—

The primary xylem cylinder is separated from the secondary xylem by a layer of thin-walled parenchyma-like cells with delicate reticulate thickenings of the cell walls (fig. 23). The sculpturing is not truly scalariform, and the bars average about 2.7 μ in width. These cells often form a solid layer about the primary xylem. In wall sculpture they greatly resemble the ray cells of the secondary xylem of *Lepidodendron* but appear to be smaller and more nearly isodiametric. They range from 18 to 85 μ in length and from 14 to 45 μ in width. This zone of cells is probably of common occurrence, and Arnold ('40) noted such a layer of poorly preserved parenchymatous cells in *L. Johnsonii*. Seward ('10) observed similar cells between the primary and secondary xylem of *L. vasculare*, and he noted that

such isodiametric elements are a characteristic feature of the boundary between primary and secondary wood in lepidodendroid stems.

The Secondary Xylem.—

Most of the specimens studied produced a sheath of secondary xylem around the primary cylinder; however, this sheath varied in thickness from less than a millimeter to as great as 32 mm. As in other fossil lycopods, the amount was small in comparison with the size of the stem and evidently served as a secondary factor in the support of the trunk.

The first-formed secondary tracheids are from 40 to 50 μ in width. One row of these small, first-formed secondary xylem cells is separated from the adjacent row for a short distance from the primary cylinder by narrow rows of the small reticulate intraxylary cells. The secondary tracheids gradually increase in size for about 20 cells, after which they average about 185 μ , with the largest attaining 203 μ in width. The largest, however, are much smaller than the huge metaxylem cells. The length was more difficult to determine than that of the primary tracheids; several were followed for more than 15 mm. without their limits being determined.

The xylem rays are 1 to 10 cells in height and seldom over one cell in width. In size and wall sculpturing they resemble the small cells of the contact zone between the two xylem layers.

In one specimen an unusual differentiation of the secondary xylem suggests growth rings (fig. 2), two of them being present. These rings are uniform and apparently the result of climatic changes.

The numerous leaf traces have a spiral arrangement and depart from the periphery of the primary xylem, but, as previously stated, there is no definite evidence that they originated from the corona points. They depart at a very acute angle (fig. 25), climb about 3.0 mm., and then assume a horizontal course through the entire secondary wood. In the innermost xylem the traces are very narrow and for a short distance are surrounded by the small reticulate cells of the xylem contact zone. They quickly assume a compact oval shape equal to about the width of two tracheids.

The Periderm.—

Many of the specimens possess a thick periderm; steles exceeding 8 cm. in diameter display as much as 51 mm. of periderm, although the innermost part is usually poorly preserved. The leaf bases and associated phellem are generally lacking, and the periderm is split radially into large segments, giving the outer surface a fissured appearance. However, in some specimens, sufficient periderm remains to confirm that even the largest steles were *Lepidodendron*. The periderm is quite uniform and without the concentric series of gaps which have been described in *L. vasculare* and more recently in *L. scleroticum*.

In a transverse section the cells are essentially isodiametric but with radial walls that are much thicker than the tangential walls. A similar wall thickening

has been noted in *L. Johnsonii*, and Walton ('35) called attention to it in *Lepidophloios Wünschianus*. The radial and tangential dimensions of the cells are 35–60 μ and 35–75 μ respectively.

The lumen of many cells appears to contain a brownish substance which gives the periderm a resinous appearance (fig. 3). When viewed radially, it presents a storied structure (figs. 3, 4). It is also evident that the cells are divided by lateral septa with an occasional vertical division (fig. 7). These thick-walled, chambered cells appear to be similar to those described by Kisch ('13) in unidentified specimens of *Lepidodendron* and *Lepidophloios*, and by Arnold ('40) in *L. Johnsonii*. But whereas in *L. Johnsonii* the cells are in radially placed rows of 12–30 or more in the innermost phelloderm, in *L. kansanum* the entire preserved periderm consists of chambered cells. Also, the cells of *L. kansanum* are not tangentially widened as in those of *L. Johnsonii*. They are irregularly arranged with tapered ends and are 10–15 times as long as they are wide.

Resinous substances have been reported in the periderm cells of several species. The presence of this substance probably accounts for the preservation of this tissue while the innermost periderm is usually in an advanced stage of decomposition.

Discussion.—

Walton's ('35) study of *Lepidophloios Wünschianus* from the Lower Carboniferous of Arran, Scotland, is probably the most complete structural study of a fossil lycopod. The basal portion of the central cylinder of this tree was found broken into several pieces within the hollow trunk. Walton's findings help to explain the above-mentioned lack of uniformity of the central cylinder of *L. kansanum*.

Walton was able to arrange his steles in a series which showed a transition from a small primary, solid stele 2 mm. in diameter to a large medullated cylinder of 26.5 mm. His findings clearly indicate that the basal portion of the tree consisted of a solid xylem core, which became medullated above. *L. kansanum* gives good support for such a structural explanation. Here, the smallest pith cylinder also has the smallest primary stele and a large width of secondary xylem. The specimen possessing the largest pith cylinder has the largest primary stele, but the secondary xylem is almost lacking. The secondary xylem about this largest primary stele varies from none on one side to a maximum width of 970 μ on the other. This early irregularity in the production of the secondary wood has been noted in several other fossil lycopods. Our specimens do not display as complete a transition from the smallest primary stele to the largest primary stele as is shown in *Lepidophloios Wünschianus*. However, Walton's specimen represents a single tree, whereas the specimens of *L. kansanum* were collected over an area of several square miles and are from many different trees.

It is quite probable that the specimens of *L. kansanum* do not include the basal portion of the trees. Walton's tree ranged from a solid, basal core of 2 mm. diameter to a medullated cylinder of 26.5 mm. diameter, but the diameter of the smallest primary stele of *L. kansanum* is 19.5 mm. and that of the largest is 50

mm., no protostelic specimens having been found. Other evidence that the basal portions of *L. kansanum* are not represented is suggested by the complete absence of *Stigmara*, the basal organ of *Lepidodendron*, although several score coal balls were examined.

The structure of *L. kansanum* appears to conform to the size and form principle of Bower ('30). In dealing with the different types of steles found in the lycopods, Bower concluded that the primitive xylem column in fossil species could undergo one or more of four types of progressive changes, any one of which would have the effect of increasing the proportion of surface to bulk of the dead tracheidal tissue. These changes were: 1, fluting of the surface; 2, medullation; 3, cambial increase, with medullary rays; 4, segregation of the primary xylem into distinct strands. Medullation and cambial increase are present here, and fluting, as demonstrated by the corona, is conspicuous.

Table I presents a compilation of the dimensions of several accurately reconstructed steles. Concerning medullation, Bower stated that the formation of pith in the fossil lycopods has a general relation to the size of the primary xylem column but that the relation is not an exact one. He stated further that medullation brings with it an increased exposure of the dead tracheids to living cells, though this would not be as important functionally as increased exposure on the outer surface. In these specimens, the pith size does bear a relationship to the primary cylinder alone rather than to the entire woody stele. Text-figs. 1-13 show the increase in the primary stele to be somewhat proportional to the increase of the pith.

That the giant lycopods failed to survive perhaps indicates that they failed to maintain a sufficient proportion of presentation surface of dead wood to living cells, and thus the expanding primitive stem failed to meet the increasing requirements of translocation. However, to have even existed, such huge plants must have undergone some structural changes which would have maintained a proportional ratio of surface to bulk. Medullation seems to have been the chief means of stelar elaboration to prevent the tree from becoming physiologically insufficient, and despite their tracheid-like appearance the ray cells must certainly have been living cells, for they furnish the only effective means of maintaining the ratio of living to dead cells in the secondary xylem. The cells of the contact zone of the primary and secondary xylem present an added possibility of maintaining Bower's suggested ratio, particularly inasmuch as the prominent crenulations of the corona would serve to increase the surface area exposed.

Specific status is assigned to *L. kansanum*, although the absence of well-preserved external features and the possibility that only the upper tree trunks are represented leave many questions. It shows no significant departures from other large species of the genus, and there is little to distinguish it from large European species such as *L. brevifolium*. However, it differs from any previously described species of *Lepidodendron* of North America, and its great abundance in the Mineral flora is considered in giving it a specific diagnosis.

Diagnosis: Steles siphonostelic, large, with conspicuous variation in ratio of diameter of primary body and thickness of primary and secondary xylem; large pith composed of single type of thin-walled, nearly isodiametric cells; massive periderm composed of fiber-like chambered cells divided by lateral and vertical septa, uniform and not irregularly zoned by decay of less resistant cells; primary xylem limited externally by prominent corona formed by projecting exarch protoxylem elements; zone between primary xylem and secondary xylem occupied by numerous thin-walled parenchyma-like cells with reticulate wall sculpture.

Locality and Horizon: Strip mine of the Pittsburgh and Midway Coal Company, Cherokee County, Kansas; Fleming coal, Cherokee Group, Des Moines Series, middle Pennsylvanian.

Type specimens: The author is cognizant of the taxonomic problems involved in the designation of fossil types. However, the following specimens best show the characteristics of this species: WCB 706, WCB 767, WCB 770, WCB 821, and WCB 824, Washington University, St. Louis.

LEPIDODENDRON dicentricum Felix, sp. nov.

The description is based on a number of small stems, but not as many as of *L. kansanum*.

The Stele.—

The primary xylem is of particular interest. It consists of an inner and an outer xylem which are sharply differentiated from each other (pl. 27, fig. 18). One small stele (WCB 781), 9.5 mm. in diameter, has an excellently preserved inner primary xylem 5 mm. in diameter. It is composed of short, barrel-shaped, nearly isodiametric tracheidal elements (pl. 26, figs. 14, 16). The cell walls are distinguished by delicate scalariform and reticulate thickenings, and "Williamson's striations" are also present. The cells range from 70 to 300 μ in length and 50–175 μ in width. A larger specimen (WCB 775), with a stele of 18.5 mm. in diameter, contains an inner primary xylem 9 mm. in diameter.

The outer primary xylem is continuous about the inner. There is no noticeable corona, but there are exarch protoxylem elements. The small protoxylem cells measure 8–25 μ in diameter, and spiral thickenings are present in the smallest cells. The larger metaxylem cells are 40–190 μ in diameter and are scalariform. The tapering tracheids average about 15 mm. in length.

A similar central cylinder is characteristic of *L. vasculare*, in which the outer edge of the primary stele consists of narrow tracheids. Toward the center the diameter of the tracheids gradually increases, and parenchymatous cells mingle with elongated scalariform elements. The central region is composed of parenchyma arranged in vertical series of short cells, interspersed with short tracheids distinguished by greater wall thickness and scalariform and reticulate thickenings.

In *L. dicentricum* there is a clear differentiation between the outer and inner primary xylem zones (fig. 13). There is no mixture of tracheids and parenchyma, all cells of the central region being tracheidal.

The origin of pith has been an important and debated problem, and the central organization of *L. dicentricum* seems worth consideration. It is generally accepted that the siphonostele developed from the protostele, either as a cortical "invasion" (Jeffrey, '10, '17), or as a modification of the central part of the protostele (Boodle, '01, and Gwynne-Vaughan, '03). The intrastelar pith origin has received its chief support from studies of lepidodendrids, *L. vasculare* being one of the better known. The central region of the pith, known as a mixed or partial pith (fig. 9), has been considered as transitional between true protosteles and true siphonosteles. The long, thick-walled tracheids with scalariform wall sculpture are mingled with long septate cells. Some of the short segments of the septate cells are thick-walled with scalariform sculpture, while others are thin-walled and without any wall thickenings, appearing parenchymatous in every respect. Thus it would seem that the pith is formed from a subdivision of tracheids into short tracheary elements, then into parenchymatous cells, and all stages may be seen in the central area of the stele of *L. vasculare*.

The primary xylem cylinder of *L. dicentricum* differs from that of *L. vasculare* in that the entire central area is homogeneous, consisting of isodiametric cells with pronounced scalariform and reticulate thickenings.

It would thus appear that this species offers clear evidence of an intrastelar origin of the pith and presents a transitional type between a protostele and siphonostele.

The parenchyma-like cells observed between the primary and secondary xylem of *L. kansanum* were evident, although generally poorer preservation rendered them more difficult to distinguish. The secondary xylem was 3 mm. in thickness in one of the better specimens. However, badly compressed material of far larger specimens was found, and the maximum dimensions probably far exceed 3 mm. The innermost tracheids of the secondary xylem are small and delicate and are from 18 to 37 μ in diameter. They enlarge gradually outwards to a diameter of 122–137 μ on the outer edge of the woody stele.

The leaf trace originated from the protoxylem cells at the periphery of the primary xylem, and, departing at an acute angle, it followed a horizontal course through the entire secondary wood. In its course through the secondary xylem the trace consists of short, scalariform cells averaging 40 μ in width and 200 μ in length. Upon leaving the secondary wood the trace follows a vertical course for several millimeters along the face of the secondary xylem (fig. 10), and in WCB 775 the trace climbed vertically for a distance of 16 mm. During this climb there is some decrease in the width of the tracheids which measure 18–33 μ . The trace follows an oblique course upward through the cortex and resumes a horizontal course through the periderm. It is more difficult to follow the leaf traces beyond the periphery of the secondary xylem, but the cortex and periderm form a network, probably due to decay of parenchymatous tissues surrounding the leaf trace, and the fragmented traces may be found in the gaps.

The Cortex.—

The cortex appears to have consisted of two zones. The inner cortex, directly adjoining the stele, is, when preserved, composed of delicate, parenchymatous cells with much thinner walls than those of the outer cortex. The well-preserved outer cortex consists of parenchymatous cells which are irregularly arranged. These cells are elongated and the ends taper slightly.

The cortical cells range from 40 to 208 μ in diameter and from 75 to 600 μ in length, with the larger and shorter cells adjacent to the xylem and the smaller and longer ones nearest the periderm. Although there is a regular decrease in cell diameter from the xylem outwards to the periderm, an intermingling of small cells throughout serves to form a large number of intercellular spaces (fig. 11).

In a tangential section the cortex presents a reticulate appearance (fig. 22). This is produced by the passage of the leaf trace and the partial breakdown of the large amounts of parenchyma cells which surround the traces. A similar cortex has been described in *L. scleroticum*, but that species was characterized by sclerotic nests of cells which are absent here.

The Periderm.—

The periderm consists of radially arranged fibrous cells with rather thick walls. In a radial section they present the uniform storied structure characteristic of *Lepidodendron*, and all cells in a series are of equal length. When viewed tangentially they show an irregular, interlocking arrangement, the cells being 640–825 μ long by 35–65 μ in radial diameter and with tapered ends.

A phellogen is occasionally visible, and many of the thin-walled cambium cells have decayed, leaving a gap between phellem and phelloderm. In WCB 775 the phellogen laid down about 130 cells to a row on the interior (phelloderm) and about 15 to the exterior (phellem), giving some idea of the ratio of these two tissues. The periderm interior to the phellogen, morphologically a phelloderm, is characterized by series of holes as if caused by decay. Various interpretations have been given to periderms with such gaps (fig. 19). Hovelacque ('92) described them in *L. selaginoides* as less-resistant layers formed at periods of slack growth. Many authors have interpreted them as secretory organs, the most recent of these being Arnold ('40). However, the periderm of *L. dicentricum* does not show the orderly tangential arrangement of glands as in *L. Johnsonii* or *Lepidophloios Wüschianus*, nor is there any cellular structure in the gaps to suggest anything but decayed or less-resistant cellular structure. The phellem is characterized by rows of tangentially widened, thin-walled cells (fig. 20). Such rows of cells have been defined by Kisch ('13) as "meshes", and the term will be used here with the same meaning.

In a smaller specimen (WCB 817) in which no secondary xylem had formed, the periderm could be observed in its earliest stages. The mesh cells of the phellem had just begun to make their appearance, and the mesh rows were only about 5 cells in length. The phelloderm of this specimen contained about 30 cells to a row.

Kisch ('13), in a comprehensive account of the periderm, described a heterogeneous periderm. As the simplest variation from the ordinary periderm cell she figures a type which has become chambered by horizontal, and occasionally vertical, septa. The most complex type of periderm which she figures is that known as "Dictyoxylon Cortex". This consists of a network of ordinary periderm cells, while the meshes, visible alike in transverse and tangential sections, are filled with thin-walled, block-like parenchymatous cells. This complex periderm has been described in *Sigillaria spinulosa*, and Williamson ('78) noted such wedge-shaped rows of cells in unidentified lycopod bark. Renault and Grand'Eury ('75), in their work on *Sigillaria spinulosa*, found the meshes absent in the inner periderm tissue but present in the outer periderm and gradually increasing in size towards the periphery. A similar occurrence may be seen here in a transverse section where the first cells of the mesh are the size of fiber cells and widen tangentially towards the outer phellem (fig. 20).

The thin-walled, tangentially widened cells of the meshes in a tangential section of the periderm are divided by horizontal septa into chambers such as those found in the inner phellem adjacent to the phellogen (fig. 15). These cells are the same as the simple chambered ones described by Kisch ('13). Each segment then appeared to undergo further vertical divisions along with horizontal divisions until the original extended cell shape disappears (fig. 12), and only the pointed end segments leave a clue to the origin of the meshes. This sequence of cells can be followed in tangential serial sections from an inner chambered cell outward through a series of increasingly complex divisions until there remains a network of a few periderm fibers about many block-like parenchymatous cells, the latter representing the first mesh cells laid down by the phellogen (text-fig. 14). The only cells of the mesh in the inner portion of the phellem are the chambered ones with a few horizontal septa. The cells of the mesh increase in size and complexity of division towards the outer phellem.

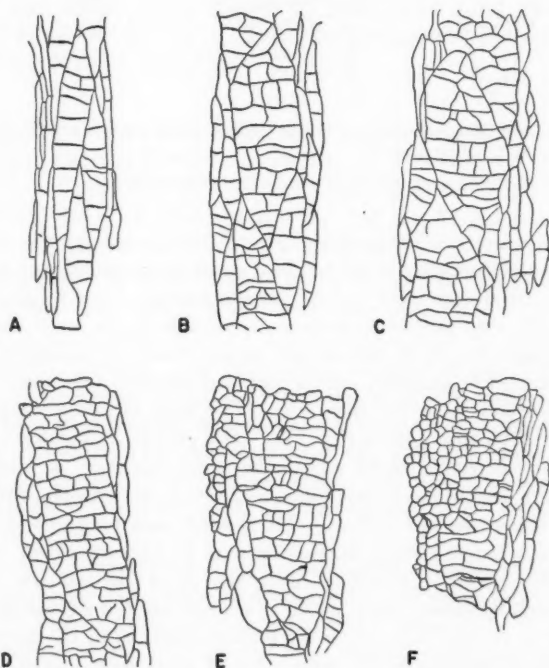
This periderm has only two cell types, the unchambered fibers of the phellogen and the phellem, and the chambered cells restricted to the phellem. The differences in the chambered cells represent stages in the formation of the "Dictyoxylon Cortex." This "Dictyoxylon Cortex" is not to be confused with the primary outer cortex of *Lyginopteris* and *Heterangium* with its strands of fibrous sclerenchyma, to which the same term is applied.

The Parichnos.—

A surface view of a leaf base of *L. dicentricum* reveals two parichnos strands, one on either side of the leaf trace. They are reniform in shape and average about 0.6 mm. by 0.3 mm. A groove about 1.8 mm. long runs across the leaf cushion beneath the strands (fig. 8). In some species, notably *L. aculeatum* and *L. sternbergi*, two oblong marks appear below the parichnos strands, one on either side of the median line. Weiss ('07) made a detailed study of such scars, which he called lateral pits, and he found that the parichnos strand joined up with two

patches of specialized cells close below the leaf scar. He described a group of delicate stellate cells joining the parichnos to the specialized cell group, and he termed these as aerenchyma. Hovelacque ('92) also described an opening beneath the parichnos, but it was a single pit-like depression similar to the one in *L. dicentricum*. He illustrated it in his paper on *L. selaginoides* and gave it the name "sillon inférieur". However, he did not mention any connection between the depression and the parichnos strands.

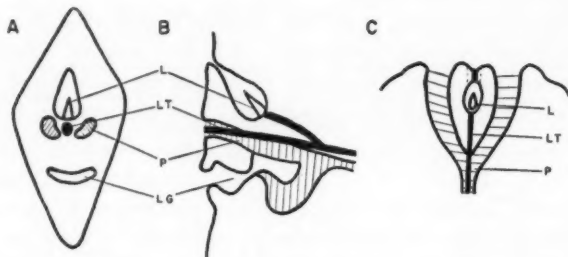
Due to faulty preservation, it has been difficult to determine the actual point where the parichnos makes its appearance. It is first observed, however, in the middle of the cortical tissue. Tangential sections of the tissue reveal large gaps which give the cortex a reticulate appearance. The gaps contain fragments of



Text-fig. 14. Camera-lucida drawings of mesh of *L. dicentricum* in tangential section of outer periderm. $\times 31$.

A. Approx. two cells or 68μ from the phellogen; B. Approx. seven cells or 306μ from the phellogen; C. Approx. eleven cells or 476μ from the phellogen; D. Approx. sixteen cells or 680μ from the phellogen; E. Approx. twenty-one cells or 850μ from the phellogen; F. The outer limits of the mesh approx. 1 mm. from the phellogen.

leaf-trace xylem accompanied by a large band of thin-walled parenchyma cells resembling those of the outer parichnos strands. The gaps can be followed through the thick-walled outer cortex and through the periderm where they continue to form a network as a result of partial decay of the parenchyma cells. These thin-walled cells completely surround the leaf trace on its journey, but the bulk of the tissue lies below the trace.



Text-fig. 15. Diagrammatic views of a leaf cushion of *L. dicentricum*: L, ligule; LT, leaf trace; P, parichnos; LG, lateral groove.

A, tangential section; B, longitudinal section; C, transverse section.

In transverse sections the parichnos strands can be seen leaving the periderm horizontally and bifurcating in the leaf base at the outermost edge of the periderm. The two strands diverge right and left of the vascular bundle, and, passing obliquely upwards, they assume positions on either side of the trace (text-fig. 15). In a longitudinal view the strands are seen to join a body of parenchymatous tissue below the point of bifurcation, and as they pass upwards they come near to the leaf-cushion surface below the trace scar. This body of tissue is exposed to the outer surface by an open groove (fig. 21). This groove corresponds to the lateral groove seen in face view (fig. 8) and to the "sillon inférieur" of Hovelacque.

Weiss ('07) worked out in detail in several species the relation of the parichnos to the scars below the leaf cushion. He showed some parichnos strands which bend downwards before leaving the cushion as in *L. Veltheimianum*. Others pursued a straight, gradually ascending course but below the leaf scar contacted a specialized aerenchymatous tissue which is exposed on the depressions below the leaf scar. In *L. dicentricum* there is a downward bending of the parichnos at the point of division resulting in the large nests of parenchymatous tissue. As the tissue appears identical to the remainder of the parichnos, it seems of little importance whether it is a downward bending of the strands or a nest of tissue. It is important, however, that here is another addition to a more efficient aerating system for these large plants. That this is a group of specialized cells such as Weiss described is entirely possible, for there is usually a small area of decayed cellular structure between the mass of cells and the main parichnos strand, and this corresponds to the position of his delicate stellate cells.

The Ligule.—

A ligule pit about 1 mm. deep is located on the upper surface of the leaf cushion immediately above the leaf trace scar. About 0.5 mm. of the ligule is usually visible, inserted obliquely at the base of the deep flask-shaped cavity (fig. 21), but it is too imperfectly preserved to reveal cellular structure. The base of the cavity lies above the leaf trace, and a strand of short tracheids forms a connection between the ligule cavity and the leaf trace. The tracheids to the ligule have delicate scalariform thickenings and range from 88 to 168 μ in length and 20 to 40 μ in width. This vascular connection of the ligule to the trace is of some interest in that neither Seward ('10), Scott ('20), nor Hirmer ('27), in their excellent surveys of *Lepidodendron*, note it. Emberger ('44) diagrammed such a connection, but perhaps the most authentic evidence has been reported by Evers ('51). He noted its presence in *L. ballii* with transfusion tissue extending from the leaf trace upward to the base of the ligule pit. A similar connection has also been reported as occurring in *L. Hickii*.

Discussion.—

An earlier reference has been made to the resemblance between *L. dicentricum* and *L. vasculare*, and it is felt that for clarification a further comparison of the two is warranted. *L. vasculare* has been treated with great detail by Seward ('10), and the excellent plates of Hovelacque ('92) and his detailed account of the anatomy leave this fossil as one of the best described.

The outer periderm of *L. dicentricum* is characterized by the rows of tangentially widened mesh cells; such cells have never been figured for *L. vasculare*.

The cortical tissue differs greatly. The inner cortex of *L. vasculare* usually disappeared at an early stage. The outer cortex consisted of two types of tissue: isodiametric cells alternated with radially arranged areas of tangentially elongated cells which extended as wedges into the inner phelloderm. In larger stems the phelloderm is characterized by its tapered form (fig. 17) as a result of decay of the elongated cortex cells. The isodiametric cells persisted. The outer cortex of *L. dicentricum* is a single cell type, and no cortical tissue extends into the phelloderm.

There are other differences of a more minor nature. The secondary xylem of *L. vasculare* usually assumes a cylindrical form of unequal width about the primary xylem (fig. 9); that of *L. dicentricum* is laid down uniformly. While the periderm of *L. dicentricum* does show series of holes, these do not appear to be the same as the regular concentric rows of apparent secretory strands in the phelloderm of *L. vasculare*.

Diagnosis: Exarch primary cylinder without prominent corona; primary xylem of two zones, an inner one of short, nearly isodiametric thick-walled cells with scalariform and reticulate thickenings, and an outer zone of elongate scalariform tracheids; secondary xylem usually present but frequently lacking in smaller stems; outer cortex of thick-walled elongated cells which decrease in diameter and increase

in length toward periderm; thick periderm irregularly zoned from apparent decay of less resistant cells, inner periderm (phelloderm) composed of radial rows of fibrous cells of secondary origin, outer periderm (phellem) characterized by rows of fibrous cells and rows of thin-walled, tangentially widened cells of cambial origin; a lateral groove present in the face of the leaf cushion beneath the parichnos strands; below leaf scar region of cushion the parichnos joins a body of parenchymatous tissue which is exposed to the outer surface by opening of the lateral groove.

Locality and Horizon: Same as for *L. kansanum*.

Type specimens: WCB 775 and WCB 781, Washington University, St. Louis.

LEPIDODENDRON serratum Felix, sp. nov.

Specimens of this *Lepidodendron* are quite numerous in the Kansas flora. Several excellent specimens, as well as numerous more fragmentary ones, were available for study. This description is based chiefly on the following three specimens: a slightly compressed stem 43 mm. by 16 mm. in diameter, which ran entirely through the coal ball (WCB 798) for a distance of 30 cm.; a specimen (WCB 707) showing branching (fig. 27), and an excellently preserved specimen (WCB 815) of one of the smaller stems (fig. 29). All the specimens were siphonostelic, and there was no evidence of the development of secondary xylem or of a periderm.

TABLE II
MEASUREMENTS OF VARIOUS ANATOMICAL COMPONENTS OF SPECIMENS FROM
COAL BALLS 798 AND 815

	No. 798	No. 815
Stem diameter including cortex	43.0 × 16.0 mm.	8.0 × 6.0 mm.
Stele diameter	9.0 × 6.0 mm.	1.0 mm.
Pith diameter	7.5 × 2.5 mm.	0.40 mm.
Width of primary xylem	2.0 mm.	0.3 mm.
Diameter of protoxylem elements	13-26 μ	16.5-27.0 μ
Diameter of metaxylem elements	59-89 × 198-260 μ	36-79 × 56-108 μ
Diameter of pith cells	36-79 μ	16-43 μ
Length of pith cells	85.8-184.8 μ	49.5-125.4 μ

Table II illustrates the weakness in designating species on the basis of measurements of anatomical components as is occasionally done. There is no doubt that these specimens belong to the same species, but the difference in size of the anatomical components is conspicuous.

Peels made of tangential stem sections of *L. serratum* show a characteristic shape of leaf bases (fig. 28). When viewed tangentially, the margins of the typical cushions appear wavy or serrate. The radial view is equally distinctive (fig. 24), and the cushion tapers off basally in a series of prominent protuberances which extend down the narrow groove separating the cushions (figs. 24, 30). Frequently the emergences are seen to run from the cushion base to the next cushion in the spiral. In WCB 815 the emergences projected from 225 to 400 μ

and even more in the larger stems. They are epidermal in origin (fig. 30) and possess no vascular tissue. The stem of *L. serratum*, with the exception of the upper portion of the leaf cushions, is clothed with the emergences, and certainly these tiny projections must have presented a distinctive appearance.

A ligule is situated in a pit near the apex of the cushion (fig. 26), and the vascular trace enters the leaf beneath the ligule. The trace is accompanied by the parichnos strand. The parichnos does not fuse with any parenchymatous tissue in the lower leaf cushion as in *L. dicentricum*, and no lateral groove is present in the face of the leaf cushion.

The Pith.—

The pith is composed wholly of unsculptured, thin-walled cells. Their size varies, with the larger cells being found in the larger stems, but all appear to be about three times as long as broad in the species.

The Vascular Tissue.—

Exarch primary xylem only is present, no secondary wood having been observed in this species. It forms a band which varies from 0.3 to 2 mm. in width in the different specimens. The largest metaxylem tracheids, which are adjacent to the pith, measure over 200 μ in diameter, and the smaller tracheids of the protoxylem measure 13–27 μ in diameter. The scalariform tracheids of all the xylem elements show "Williamson's striations".

The mesarch leaf trace departs from the edge of the xylem, and for a few millimeters it climbs almost vertically. After the trace leaves the xylem it still continues to climb at a very steep angle. In WCB 815 a trace was followed vertically for a distance of 14 mm., during which it moved 4 mm. horizontally through the cortex. The leaf trace in this species never assumes the oblique course in the cortex as is usually the case in *Lepidodendron*; rather it climbs almost vertically from its initial appearance until it enters the leaf base. A similar trace is characteristic of *L. aculeatum* Seward ('06).

Several stems exhibiting branching were found, most of them being less than 10 mm. in diameter. The branching was usually monopodial, a stem being shown in fig. 27 with two branches departing. It appears that they departed at different levels, for the branch the greatest distance from the main axis has nearly regained its normal circular form, while the one nearest the main axis still retains its crescent shape.

The Cortex.—

Directly adjoining the xylem is an area of imperfectly preserved tissue about 1 mm. in width. A band of compact parenchyma composed of small block-like cells abuts on this zone of disintegrated tissue. Two other clearly defined zones of tissue succeed this band, and a similar organization has been described in other species of *Lepidodendron*. Seward ('06) pointed out anatomical characters of *L. aculeatum* quite comparable to those of *L. serratum*. Seward termed the band of compact parenchyma the inner cortex and the succeeding zones as middle and outer cortex; the same designations are used in this description.

The inner cortex measures 0.37 mm. to 1 mm. in width in the different specimens. It is a very compact tissue of small, nearly isodiametric cells $16-46\ \mu$ in diameter and $29-100\ \mu$ in length, being about twice as long as wide. The boundary between the inner and middle cortex is quite definite due to the junction of the vertical rows of the small, blocky cells of the former with the loosely organized large, irregular cells of the latter, which tend to increase horizontally rather than vertically. The middle cortex is often badly disorganized, leaving the inner cortex as a ring about the xylem cylinder.

The cells at the inner edge of the outer cortex are short and rather flat, and in longitudinal sections they exhibit a fairly regular vertical arrangement. However, they gradually assume a more elongated form toward the outer stem surface and range in length from $39\ \mu$ at the innermost to $215\ \mu$ at the outermost edge.

The cortical organization of *L. serratum* bears a close resemblance to *L. aculeatum*. However, the external characters of the latter are greatly different from those of *L. serratum*. Seward ('10) discussed the resemblance which his *L. aculeatum* showed to *L. fuliginosum*, a species for which specimens have been described with external characteristics of *Lepidodendron* and *Lepidophloios*. It appears quite evident that the same anatomical characteristics may be associated with more than one specific form of stem as defined by the form of the leaf cushions.

The Ligule.—

The ligule pit has a narrow orifice which opens into a flask-shaped structure within the leaf cushion (fig. 26). The pit is set at a very acute angle and is approximately 1 mm. deep. The ligule itself is frequently well preserved in these specimens, and in WCB 815 several ligules were present, occupying the enlarged basal portion of the pit cavity. The preserved ligule was usually about $330\ \mu$ long and varied in width from $130\ \mu$ at its base to $85\ \mu$ at the distal end. The cellular structure is composed of thin-walled parenchymatous cells. They are isodiametric and measure $15-20\ \mu$ in diameter. There is no evidence of vascular tissue between the ligule and the leaf trace as occurred in *L. dicentricum*.

Discussion.—

The pith of *Lepidodendron* might well serve as an aid in identification of species. In *L. kansanum* the pith cells were nearly isodiametric, and Evers ('51) found the same to be true in *L. wilsonii*. However, Evers reported that the pith cells of *L. ballii* were six times as long as broad. In *L. serratum* they are three times as long as broad. All the specimens mentioned above possess a pith which is a single cell type, but Arnold ('40) described a pith of two distinct zones in *L. Johnsonii*.

The presence or absence of secondary wood is not a dependable specific character in *Lepidodendron*, and it is questionable as to how much importance may be attached to its absence in *L. serratum*. It does not seem unreasonable to assume that this plant had reached maturity in the larger specimens, although far smaller specimens of *Lepidodendron* are known in which secondary xylem has developed,

and smaller specimens of *L. dicentricum* occurred without secondary wood but with periderm tissue present. In WCB 820 a specimen of *L. serratum* has 14 mm. of cortical tissue without the appearance of a periderm. Frequently the worker is overly impressed by the size of the specimen, a character which is not necessarily fundamental, and there is little reason why *L. serratum* cannot represent the mature state despite its small size. Approximately twenty specimens were found, and often almost entire coal balls consisted of tangled masses of badly compressed remains of *L. serratum* associated with a varied flora. However, not a single specimen with secondary vascular or cortical development was present. Indications are that it might have been a lax, flexuose plant which branched frequently, and its lack of secondary growth would have afforded such a plant very little support.

Diagnosis: Exarch siphonostelic primary body; secondary xylem development and periderm formation lacking; leaf bases long and tapering with serrate margins; stem clothed with numerous small, epidermal emergences which occur on all plant parts except the upper leaf cushion; homogeneous pith of thin-walled cells 3 times as long as broad, no tracheid-like cells appearing in the pith; leaf trace mesarch, following a steep, almost vertical course from the xylem to the leaf base; cortex of three zones: a compact inner cortex of small, nearly isodiametric cells, a middle one of loosely organized, large, irregular cells, and an outer one of compact cells, increasing in length toward the outer periphery of the stem; branching frequent, characterized by an unequal dichotomy.

Locality and Horizon: Same as for *L. kansanum*.

Type specimens: WCB 707, WCB 798, and WCB 815, Washington University, St. Louis.

Acknowledgment.—

The author wishes to express appreciation of the guidance and constructive criticism of Dr. Henry N. Andrews, under whose direction this work was accomplished.

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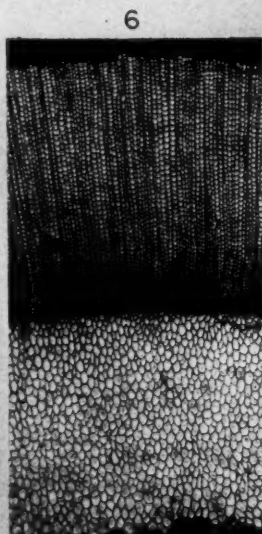
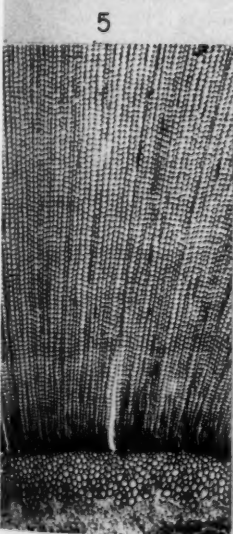
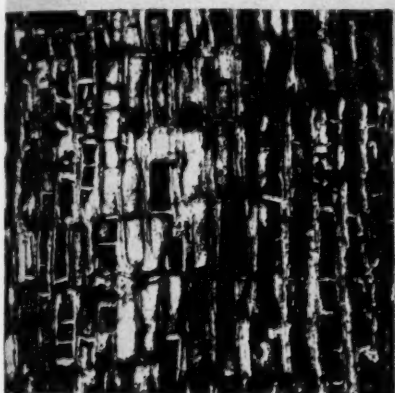
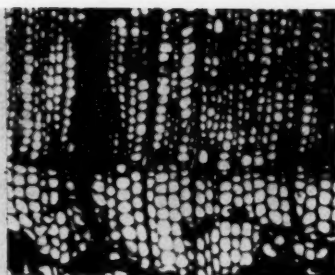
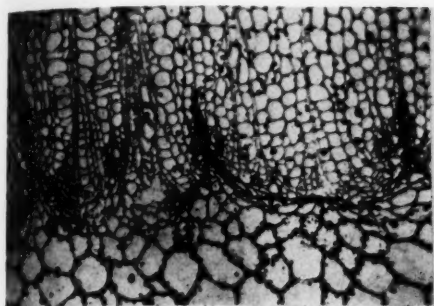
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EXPLANATION OF PLATE 25

Lepidodendron kansanum Felix

- Fig. 1. Transverse section, showing corona projections of the primary xylem. WCB 704, $\times 38$.
 Fig. 2. Transverse of outer secondary xylem, showing zone of differentiated xylem. WCB 802, $\times 15$.
 Fig. 3. Radial section of periderm, showing dark contents of the cells. WCB 770, $\times 35$.
 Fig. 4. Radial section of periderm, showing the evenly aligned cells. WCB 774, $\times 35$.
 Fig. 5. Transverse section, showing primary xylem and adjacent secondary xylem. WCB 702, $\times 5$.
 Fig. 6. Transverse section, showing primary xylem and adjacent secondary xylem. WCB 704, $\times 8$.
 Fig. 7. Tangential section of periderm, showing septate cells. WCB 770, $\times 38$.



FELIX—ARBORESCENT LYCOPODS

EXPLANATION OF PLATE 26

Lepidodendron dicentricum Felix (Except fig. 9)

Fig. 8. Tangential section, showing leaf cushion with lateral groove beneath the ligule. WCB 775, $\times 5$.

Fig. 9. Transverse of young stele of *Lepidodendron vasculare*. $\times 7$.

Fig. 10. Radial section through stem, showing trace departing from secondary xylem. WCB 775, $\times 44$.

Fig. 11. Transverse section of cortex. WCB 775, $\times 44$.

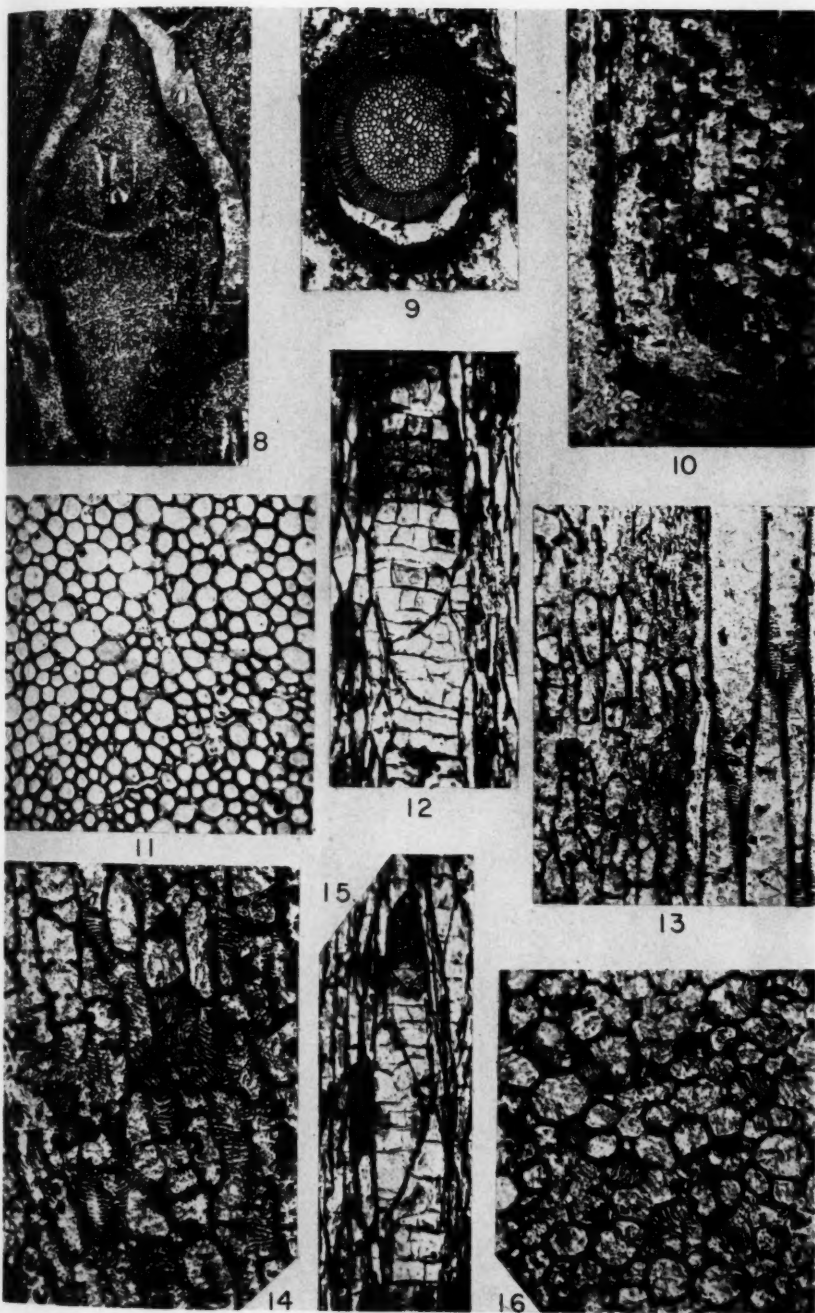
Fig. 12. Tangential section of outer phellem, showing mesh cells. WCB 775, $\times 45$.

Fig. 13. Radial section, showing the inner primary xylem (left) and adjacent cells of the outer primary xylem (right). WCB 781, $\times 40$.

Fig. 14. Radial section through inner primary xylem, showing wall sculpturing of cells. WCB 781, $\times 60$.

Fig. 15. Tangential section of inner phellem, showing mesh cells. WCB 775, $\times 45$.

Fig. 16. Transverse section through inner primary xylem, showing wall sculpturing of cells. WCB 781, $\times 60$.



FELIX—ARBORESCENT LYCOPODS

EXPLANATION OF PLATE 27

Fig. 17. Transverse of older stem of *Lepidodendron vasculare*, showing the tapered phelloderm, $\times 2\frac{1}{2}$.

Lepidodendron dicentricum Felix

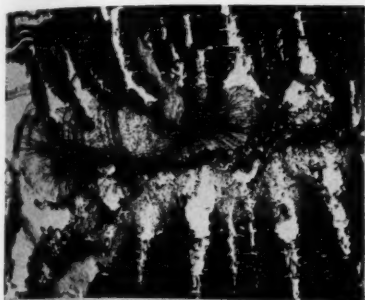
Fig. 18. Transverse of stele, showing inner and outer primary xylem with adjacent secondary xylem. WCB 781, $\times 7$.

Fig. 19. Transverse of outer portion of stem, showing periderm. WCB 775, $\times 5$.

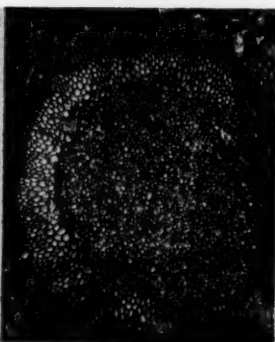
Fig. 20. Transverse of phellem, showing single row of mesh cells. WCB 775, $\times 33$.

Fig. 21. Radial section through leaf cushion: L, ligule; VT, vascular tissue; LG, lateral groove. WCB 775, $\times 34$.

Fig. 22. Tangential section of cortex, showing reticulate appearance due to departing traces. WCB, 775, $\times 3\frac{1}{2}$.



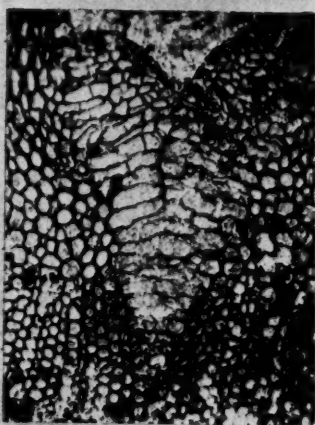
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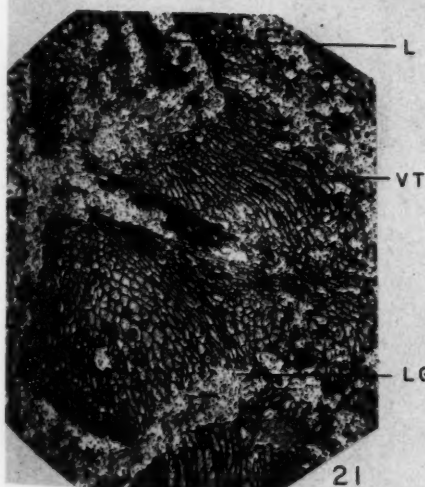
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FELIX—ARBORESCENT LYCOPODS

EXPLANATION OF PLATE 28

Lepidodendron kansanum Felix

Fig. 23. Tangential section, showing zone of parenchymatous (P) cells between primary and secondary xylem. Dark strands (PX) represent the protoxylem ridges. WCB 767, $\times 60$.

Fig. 25. Radial section, showing leaf trace departing from the primary xylem. WCB 706, $\times 48$.

Lepidodendron serratum Felix

Fig. 24. Radial section of outer cortex, showing epidermal protuberances. WCB 815, $\times 28$.

Fig. 26. Radial section of leaf cushion, showing ligule. WCB 815, $\times 54$.



P

PX

23



24



25



26

FELIX—ARBORESCENT LYCOPODS

EXPLANATION OF PLATE 29

Lepidodendron serratum Felix

- Fig. 27. Transverse section of stem, showing branching stele. WCB 707, $\times 4$.
Fig. 28. Tangential section of stem, showing the leaf bases. WCB 798, $\times 3\frac{1}{2}$.
Fig. 29. Transverse section of small stem. WCB 815, $\times 10$.
Fig. 30. Enlarged view of epidermal protuberances. WCB 815, $\times 60$.



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FELIX—ARBORESCENT LYCOPODS

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THE HISTORY OF THE USE OF THE TOMATO: AN ANNOTATED BIBLIOGRAPHY*

GEORGE ALLEN McCUE

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FOREWORD BY EDGAR ANDERSON

In working out the history of a cultivated plant there are two effective avenues of approach. We may use purely botanical evidence and trace the connections between the modern crop and its original wild progenitors. We may, on the other hand, study the history and development of the ways in which a particular crop is used. With the tomato, this other kind of evidence throws a wholly new light on its history and presents us with a previously unsuspected problem: where and how did Europe get not only the tomato but an appreciation of its enormous culinary and dietary potentialities?

When McCue began his studies of the tomato it was soon apparent that the problem was a much larger one than had been supposed. He has accordingly presented his data as an annotated bibliography from which other scholars may proceed in beginning their research.

The botanical facts about the tomato are simple. It belongs to a genus of weed-like plants native to northwestern South America. By processes as yet unknown the cultivated sorts developed out of these small-fruited weeds and spread to Mexico by the time of the Conquest. The facts with regard to the history of the use of the tomato are far more complex. McCue's bibliography establishes the fact that our appreciation of its dietary importance is quite modern and that it came to us, not from Mexico, but by way of the Italians and the French. The bibliography also suggests (though it does not go far enough to establish definitely as a fact) that the French in turn took over the use of tomatoes from the Italians and that the Italians themselves acquired it from the Turks, or at least from peoples in the Levant.

*An investigation carried out at the Missouri Botanical Garden and submitted as a thesis in partial fulfillment of the requirements for the degree of Master of Arts in the Henry Shaw School of Botany of Washington University.

Where did the Turks become acquainted with the usefulness of the tomato? From a series of interviews made for another purpose and as yet unpublished, I can enlarge the question raised by Mr. McCue's bibliography. There is a wide and apparently coherent area in which the tomato has been used for a long time (one does not know precisely how long but it is certainly a matter of centuries) as a part of the everyday diet of everyday people. Throughout that area it is used in sauces and in meat and vegetable mixtures. Throughout that area for winter use it is dried (or half-boiled, half-dried). Throughout most of that area there are meaty varieties with relatively little juice which lend themselves well to such practices. This area now extends from southern France to Italy through the Balkans, throughout Turkey and into the edge of Iran. Towards Arabia and Ethiopia its boundaries are not so sharp and are difficult to determine for a variety of reasons.

How and when did the tomato become so closely identified with Levantine culture? This is a difficult problem but one which could eventually be solved by carefully executed research. Mr. McCue's bibliography points out one of the routes by which we can find the answer.

INTRODUCTION

There are several pieces of information which may aid the reader in his use and evaluation of this bibliography.

Initially it might be prudent to emphasize the limits of this work as indicated by the title. It seeks only to present an annotated bibliography of the history of the *use* of the tomato. Nomenclature, origin, development, etc., have been considered only in so far as they bear upon the problem of usage.

By far the major part of the titles cited are in the library collections of the Missouri Botanical Garden, including the Sturtevant Pre-Linnean collection. Smaller numbers are from the collections of the Folger Shakespeare Library, Washington, D. C.; the Library of Congress; the Library of the Department of Agriculture; and the Library of Washington University, St. Louis, Mo.

As a glance at the table of contents will reveal, the citations have been first grouped geographically. A dozen areas covering most of the world's surface were chosen with as much correspondence to historical unity (in terms of the tomato) as possible. Some serious compromises with this principle were made, however, in the interests of simplicity and workability. For example, in terms of the history of the use of the tomato, the categories of Asia and Africa are extremely heterogeneous. However, the number of references in either of the two categories is too small to give any meaning to further division. The same is true of the artificial category designated "South Pacific."

It will be noticed that there is a large area omitted from any consideration in this bibliography: neither Central America nor South America have been included.

There seems to be adequate justification for this omission. These areas are, from all evidence, the home of the tomato both wild and cultivated; its use in these areas is quite ancient. Thus, the history of the use of the tomato in most of these areas is a very different problem from the one which necessarily would be the focus for the rest of the bibliography, namely, the history of the usage of the tomato among peoples to whom it was introduced, fully developed as a food plant, in comparatively recent times. Certainly, the problem of research is very different.

Within each geographical unit there has been a further chronological division. In general the literature is covered from the first mention of the tomato in a given area until it has achieved substantial popularity in the same area. A very few of the best of the modern works which touch in some way upon the history of the use of the tomato have been included under their publication dates. These are further identified in their annotations.

Whenever possible pertinent material in each work has been quoted, if in modern English, verbatim. Old English spelling has been modernized, however, and all other languages have been quoted in a close but free English translation. All translations have been identified with the abbreviation "(Tr.)." In no case have titles been translated or had their spelling modified. However, in the case of some of the older works particularly, only enough of some of the quite lengthy titles have been quoted to identify the work unmistakably.

Frequently a single work will contain references to the use of the tomato in several countries or to several different periods in the same country. Such references are quoted in their entirety only once and cross references are made. In the case of several older works which appeared in several editions, published in different countries and different languages, the complete annotation appears either in the country and under the date of the earliest edition or under the date of the first English edition. In these cases cross references have been made. Agnes Arber's 'Herbals'¹ has been used as an authority for much of the information concerning the older works (1544-1670).

Acknowledgments.—I should like to acknowledge my deep indebtedness to Dr. Edgar Anderson for his inspiration and guidance; to the members of the library staff of the Missouri Botanical Garden, for encouragement and assistance above and beyond the call of duty; to Dr. Louis B. Wright and the trustees of the Folger Shakespeare Library for the financial aid which enabled me to visit and work at the Folger Library and other libraries in the Washington area; and to Dr. Wright and the staff of the Folger Library for their kindness and help during that visit.

ITALY

- 1544—Matthiolus, Petrus Andreas. *Di Pedacio Dioscoride Anazarbeo libri cinque della historia, et materia medicinale trodotti in lingua volgare Italiana.* Venetia, 1544.

¹Arber, Agnes. *Herbals, Their Origin and Evolution.* New edition. University Press. Cambridge, 1938.

p. 326. In a chapter on the mandrake (*Mandragora*) the following description of the tomato occurs: "Another species [of Mandrake] has been brought to Italy in our time, flattened like the melerose [sort of apple] and segmented, green at first and when ripe of a golden color, which is eaten in the same manner [as the eggplant—fried in oil with salt and pepper, like mushrooms]." (Tr.)

This reference seems to antedate by six to ten years the next mention of the tomato in the literature of western Europe.

Petrus Matthiolus was a physician by trade, but his chief claim to fame lies in the several editions of this literary work, which is nominally a commentary on the work of the botanist Dioscorides. Actually, these commentaries were greatly enriched. Some of the new plants, Arber notes, were Matthiolus' own observations, "but most of the species which he described for the first time were not his own discoveries." His correspondents, who made the major contributions of new species to the *Commentarii*, included a Turkish diplomat, Busbecq, and his personal physician, Quakelbeen; and also the famed physician, botanist and teacher, Luca Ghini, who founded the botanical garden at Pisa.

Just who was responsible for the observations on the tomato which appear in the *Commentarii* is not known. The briefness of the account makes it seem almost epistolary; on the other hand, it is apparently an observation made in Italy.

One of the most commonly quoted pieces of information on the early use of the tomato is the statement "that it is eaten in Italy with oil, salt, and pepper." Dozens of later authors, writing in every major western European language, repeat Matthiolus' observation.

1548—De Toni, G. B. "Spigolature Aldrovandiane. VI. Le piante dell'antico Orto Botanico di Pisa ai tempi di Luca Ghini." *Annali di Botanica*. Volume V. pp. 421–440. Roma, 1907.

The botanical garden at Pisa is the oldest such institution in the western world. This reprint of the manuscript catalogue of the 620 plants which were in the garden in 1548 does not include any plant identifiable as the tomato.

1554—Matthiolus, Petrus Andrea. *Commentarii in libros sex Pedacii Dioscoridis Anazarbei, de medica materia*. Venetiis, 1554.

p. 479. In chapter headed *Mandragoras* opp. marginal note, Matthiolus reports that "the eggplant is commonly eaten cooked in the manner of mushrooms, with oil, salt, and pepper."

This edition differs from the 1544 Italian version essentially only in that it mentions the Italian name for the tomato, "*Pomi d'oro*," and its Latin equivalent, "*Mala aurea*," and takes note of a red variety.

The following editions of the *Commentarii* [Venetiis] contain passages concerning the tomato identical to the one in the 1554 edition: 1558, p. 537; 1560, p. 537; 1570, p. 684; 1583, p. 425.

1550–1600—There are several herbarium specimens dating from this period:

1. Jerna, Gaetano. "Qualche Cenno di Storia sul Pomodoro in Italia." *Humus*. Volume III. No. 9. September, 1947.

p. 26. Jerna reports that there is a sheet labelled: "*Malus insana, Mandragorae species Poma amoris*"² in an herbarium in the Biblioteca Angelica di Roma attributed by Professor Emilio Chiovenda to Francesco Petrollini and dated between 1550 and 1560.

2. ———. In the same article, Jerna reports that in an index to an herbarium, preserved in the manuscripts of Ulisse Aldrovandi at Bologna, there is listed a specimen bearing the names: "*Malus insana altera, Poma amoris*." Professor Chiovenda attributes this herbarium to Petrollini also and assigns the same dates, 1550 to 1560, to its preparation.

3. Mattiolo, O. *Illustrazione del Primo Volume dell'Erbario di Ulisse Aldrovandi*. Genova, 1899.

p. 129. The sixteen-volume herbarium of Ulisse Aldrovandi, now preserved at the Botanical Garden of Bologna after many wanderings, is generally conceded to be the oldest extant herbarium in the world. Aldrovandi, a pupil of Luca Ghini, apparently began his collecting about 1551, and by 1570 had collected fourteen volumes. Specimen No. 368, in the first volume,³ consists of a leaf and a small inflorescence and is labelled "*Pomum amoris. Mali insani species. Tembul quibusd.*" Mattiolo describes the specimen as well preserved, but reports that it is on the sheet with two leaves of "*Cuccumis*" *Citrullus*.

Mattiolo states that most of the plants were collected in the vicinity of Bologna, although there are a few cultivated plants, a few plants from foreign countries and some alpine.

4. Michiel, Pietro Antonio. "I cinque libri di piante." *Codice Marciano*, 1551-1575.

Prof. Jerna (see 1 & 2 above) reports that in this "herbarium," which actually consists of colored illustrations of the plants, there is included (*Libro Rosso* I N. 46) a representation of a tomato. The illustration is labelled: "*Licopersico Galeni —pomodoro da volgari, poma amoris da alcuni et del Peru.*" Its *virtu* is also described: "If I should eat of this fruit, cut in slices in a pan with butter and oil, it would be injurious and harmful to me." (Tr.)

5. Camus, J., and Penzig, O. *Illustrazione del Ducale Erbario Estense del XVI secolo Conservato nel R. Archivio di Stato in Modena*. Modena, 1885.

p. 35. Specimen 142 is labelled "*Pomi di Ettiopia ouer Pomi d'oro.*"

This herbarium is dated by Camus and Penzig between 1570 and 1600.

1570—Pena, Petrus, and de l'Obel, Mathias. *Stirpium adversaria nova* . . . Londini, 1570.

pp. 108-109. (See Great Britain, 1570. Pena.)

1572—Gvilandinvs, Melchior. *Papyrvs, hoc est commentarivs in tria, C. Plinij Maioris de papyro capita* . . . Venetiis, 1572.

²The names attached to this specimen indicate that it may well be an eggplant rather than a tomato.

³The Aldrovandi specimen cited above is apparently the basis for the listing, "1551, Aldrovandi," appearing on p. 232 in P. A. Saccardo's *Cronologia della Flora Italiana*. (Padova, 1909.)

pp. 90-91. Guilandini discusses the plant which Galen has named *Lycopersion*. He suggests that the plant to which Galen refers may be one of three plants including the "tumatle of the Americans." He discusses each of these possibilities. Nothing is said directly concerning the use of the tomato, but it is noted that the juice of the *Lycopersion* of Galen, whatever that plant might be, was useful because of its cooling nature for rheumy joints and other such pains.

1581—de l'Obel, Matthias. *Kruydtboeck oft beschryuinghe van allerley ghewassen, kruyderen, hosteren, ende gheboomten*. Antwerp, 1581.

p. 331. (See Central Europe, 1581. de l'Obel.)

1583—Caesalpinus, Andrea. *De Plantis libri XVI*. Florentiae, 1583.

p. 211. "*Mala insana* are rather round, like apples; we know two different kinds; one of golden color like *Malum Appium*; whence some call it "golden apple;" the other type squatty and broad, like *Malum roscum*, marked by furrows, reddish in color like flame . . . [they are] two or three cubits long . . . [their] flowers are white. Both of them are foreign; they are cultivated in gardens to look at more than to use. Some, however, eat their fruit prepared in dishes, as *Pyra insana*, [the egg plant], but they have a certain musky odor, particularly the red ones. I think they are related to certain types of *Solanum furiosum*." (Tr.)

About the preparation of *Pyra insana*, Caesalpinus says: "The fruits are eaten before ripe, thoroughly boiled or roasted in the manner of mushrooms. Its flavor imitates mushrooms, but not without strong condiments, such as pepper, in order to remove the wild flavor." (Tr.)

His reference to the white color of the tomato flower must be, generally speaking, incorrect.

1585—Durante, Castor. *Herbario Nuovo*. Roma, 1585.

p. 372. *Pomi d'oro*.

"They are cold, but not so cold as the Mandrake. They are eaten in the same way as the eggplant, with pepper, salt and oil, but afford little and poor nourishment." (Tr.)

While this volume is certainly not a translation of any one work, the section devoted to the *Pomi d'oro* is obviously of an eclectic nature. The passage quoted seems to be a slightly altered version of a similar statement in Dodonaeus (see Central Europe, 1574). Another section sounds like Matthiolus (1544, see above).

The 1602, 1607, and 1617 editions of *Herbario Nuovo* (published in Venice) also contain the passage quoted above, on p. 372.

1586—Camerarius, Ioachim. *De plantis epitome vtilissima*, Petri Andreae durch . . . Ioachim Camerarium. Franckfurt am Mayn, 1586.

pp. 378-379. (See Central Europe, 1586. Matthiolus.)

1586—Camerarius, Ioachim. *De plantis epitome vtilissima*, Petri Andreae Matthioli . . . Francofurti ad Moenum, 1586.

p. 821. (See Central Europe, 1586. Camerarius.)

1588—Camerarius, Ioachim. *Hortus medicus et philosophicus: in quo plvrimarvm stirpivm breves descriptiones*. Francofurti ad Moenum, 1588.

- p. 130. (See Central Europe, 1588. Camerarius.)
- 1597—Gerarde, John. The herball or generall historie of plants. London, 1597.
p. 275. (See Great Britain, 1597. Gerarde.)
- 1613—Tabernaemontanus, Iacobus Theodorus. Neuw vollkommentlich Kreuter-
buch . . . Franckfurt am Mayn, 1613.
Volume II. p. 494. (See Central Europe, 1613. Tabernaemontanus.)
- 1640—Parkinson, John. Theatrum Botanicvm. London, 1640.
p. 352. (See Great Britain, 1640. Parkinson.)
- 1651—Bavhins, Ioh., and Cherlervs, Ioh. Hen. Historia plantarvm vniversalis,
nova, et absolvtissima cvm consensv et dissensv circa eas. Ebrodvnii,
Volume III, 1651.
Volume III. pp. 620–621. (See Central Europe, 1651. Bavhins.)
- 1666—Ambrosinus, Hyacinthus. Phytologiae hoc est de plantis partis primae
tomus primus. Additis aliquot plantarum viuus iconibus . . . Bononiae
[Bologna], 1666.
p. 86. "*Pomum amoris* is so named because amatory powers are attributed to
it or because it has a fitting elegance or beauty worthy to command love." (Tr.)
- 1673—Ray, John. Observations made in a Journey through part of the Low
Countries, Germany, Italy, and France. London, 1673.
pp. 406–407. Many fruits [the Italians] . . . eat which we either have not or
eat not in England . . . including Love apples . . ."
Several other varieties of *Solanum* are mentioned in this work (pp. 235, 267,
277, 407). The quoted passage seems to be the only reference to the tomato.
- 1686—Raius, Joannes. Historia Plantarum. London, 1686.
Volume I, p. 675. (See Great Britain, 1686. Raius.)
- 1696—[Matthiolum, P. A.] Theatrvn botanicvm. Das ist: Neu vollkommenes
Kräuter-Buch . . . erstens zwar an das Taglicht gegeben von Herren
Bernhard Verzascha, anjetzo aber in eine gantz neue Ordnung gebracht
. . . durch Theodorvm Zvingervm. Basel, 1696.
pp. 896–897. (See Central Europe, 1696. Matthiolum.)
- 1710—Salmon, William. Botanologia. The English Herbal or, History of Plants.
London, 1710.
pp. 29–30. (See Great Britain, 1710. Salmon.)
- 1719—Tournefort, J. P. The Compleat Herbal of Mr. Tournefort. (Translated
from the Latin with additions from Ray, Gerard, Parkinson, and
others). London, 1719.
Volume I, p. 214. (See Great Britain, 1719. Tournefort.)

1721—Miller, Joseph. *Botanicum Officinale; or a Compendious Herbal*. London, 1721.

p. 32. (See Great Britain, 1721. Miller.)

1727—Boerhaave, Hermannus. *Historia plantarum, quae in Horto Academico Lugduni-Batavorum crescunt . . . Romae*, 1727.

Pars secunda, p. 509. (See Central Europe, 1727. Boerhaave.)

1731—Miller, Philip. *The Gardeners Dictionary*. First edition. London, 1731.

In alphabetical sequence under *Lycopersicon*. (See Great Britain, 1731. Miller.)

The 1737, 1741, 1748, 1752, 1759, and 1768 editions of this work contain references concerning the use of the tomato in Italy which are identical to that in the 1731 edition.

1737—Blackwell, Elizabeth. *A Curious Herbal containing Five hundred Cuts of the most Useful Plants, which are now used in the Practice of Physick*. London, Volume I, 1737; Volume II, 1739.

Volume I. Facing plate 133. (See Great Britain, 1737. Blackwell.)

1744—Zuingerus, Theodorus. *Theatrum botanicum, das ist: Volkommenes Kräuterbuch . . . Itzo auf das Neue übersehen, und mit vielen Beschreibungen und Figuren der Kräuter vermehret durch Friedrich Zwinger, des seel. Authors Sohn, . . . Basel*, 1744.

p. 1088. (See Central Europe, 1744. Zuingerus.)

1745-1775—Jerna, Gaetano. "Qualche Cenno di Storia sul Pomodoro in Italia." *Humus*. Volume III. No. 9. September, 1947.

p. 27. The author speculates as to the reasons why the tomato did not become immediately popular in Italy. He particularly wonders how the Neapolitans, in whose diet the tomato now forms such an important part, could have gotten along without the plant. Jerna apparently believes that some sort of aura of bad luck was cast around the plant much as it had been about the potato. He points out that the name "*Pomme d'Amour*" in itself suggests an aphrodisiacal quality in the fruits. Apparently the same quality was attributed to the potato. As to what broke down those barriers—Jerna suggests "probably the famous famines of 1745, 1771, and 1774 induced the people of southern Italy to take confidence in the tomato, much as it happened in Great Britain and France with the potato." (Tr.)

1755—Hill, John. *The Useful Family Herball*. Second edition. London, 1755.

p. 11. (See Great Britain, 1755. Hill.)

1769—Saccardo, P. A. *I codici botanici figurati e gli erbari . . . Venezia*, 1904.

A reprint of: Agosti, Giuseppe. *Exercitationes botanicae per agrum Bellunensem, seu Plantarum in agro Bellunensi sponte nascentium vel arte excultarum . . .* Two volumes. Belluni, 1769.

p. 14. letter c. *Lycopersicon*. It is listed as a cultivated plant.

- 1776—Onomatologia Botanica Completa. Frankfurt and Leipzig, 1772–78.
Volume VIII, 1776.
Volume VIII. p. 619. (See Central Europe, 1776. Onomatologia.)
- 1779—Linné, Carl von. Vollständiges Pflanzensystem nach der 13ten lateinschen Ausgabe und nach Anleitung des holländischen Houttuyschen Werks übersetzt. [von G. F. Christmann und G. W. F. Panzer]. Nürnberg, 1779.
Volume V. pp. 681–683. (See Central Europe, 1779. Linné.)
- 1786—de la Lande, I. I. Voyage en Italie . . . Second edition. Paris, 1786.
Volume I. p. 510. "One also begins to find in Lombardy a fruit that is common in Rome, and which is slightly known in Paris: the *pommes d'oro*, *Pomidoro*, or *Tomate* of the Spaniards." (Tr.)
- 1787—Salat-Gewächse. Frankfurt am Main, 1787.
p. 197. (See Central Europe, 1787. Salat-Gewächse.)
- 1789—Rozier, François, Abbé, editor. Cours complet ou dictionnaire d'agriculture. Paris, 1789.
Volume VIII. p. 177. (See France, 1789. Rozier.)
- 1790—Sibly, E. Culpeper's English Physician and Complete Herbal. London, 1790.
p. 228. (See Great Britain, 1790. Sibly.)
- 1792—Walters, Johann Iacob. Gartenkunst. Stuttgart, 1792.
p. 118. Walters says that the tomato, like the eggplant, is eaten by the Spaniards, Portugese and part of the Italians and French.
- 1794—Dictionnaire des Plantes Usuelles. Paris, 1794.
Volume VI. p. 145. (See France, 1794. Dictionnaire.)
- 1796—Bechstein, Johann M. Kurzgefaste gemeinnutzige Naturgeschichte der Gewächse des In- und Auslandes. Leipzig, 1796.
Volume I. p. 333. (See Central Europe, 1796. Bechstein.)
- 1799—Jolyclerc, N. Phytologie Universelle. Paris, 1799.
Volume IV. p. 214. (See France, 1799. Jolyclerc.)
- 1802—Anonymous note. The Cultivator. New Series. Volume IX. Albany, N. Y., 1852.
p. 381. (See U. S., 1802. Anonymous.)
- 1804—Bianchi, —. "Ueber den Anbau und Küchengebrauch der Tomatis, oder Liebesäpfel (*Solanum Lycopersicum* L.)." Allgemeines Teutsches Garten-Magazin. Volume I. Weimar, 1804.
p. 377. (See Central Europe, 1804. Bianchi.)

1811—Re, Filippo. L'Ortolano. Milan, 1811.

pp. 268–271. Three varieties of "*Pomidoro*" are listed and described: *P. Schiacciato*; *P. A. Peretto*; *P. Globoso*. Directions for their culture are given. Presumably these plants are being raised as food plants.

1811—Sickler, J. V. Garten-Handlexikon. Erfurt, 1811.

———. (See Central Europe, 1811. Sickler.)

1822—Loudon, J. C. An Encyclopaedia of Gardening. London, 1822.

p. 763. (See Great Britain, 1829. Loudon.)

1829—Loudon, J. C. An Encyclopaedia of Plants. London, 1829.

p. 160. (See Great Britain, 1829. Loudon.)

1840—Dewey, Chester. Report of Herbaceous Flowering Plants of Massachusetts. Cambridge, 1840.

p. 166. (See U. S., 1840. Dewey.)

1841—Russell, J. W. "On the Culture of the Tomato and Egg Plant." Magazine of Horticulture. Volume VII. Boston, New York; 1841.

p. 97. (See U. S., 1841. Russell.)

1842—Anonymous. "The Tomato and its Uses." The Cultivator. Volume IX. Albany, N. Y., 1842.

p. 167. (See U. S., 1841. Anonymous.)

1853—Anonymous. "Notizen." Gartenflora. Volume II. Erlangen, 1853.

pp. 248–249. (See Central Europe, 1853. Anonymous.)

1857—Hassenstein, ———. "Ueber die Benutzung der Liebesäpfel." Gartenflora. Volume VI. Erlangen, 1857.

p. 54. (See Central Europe, 1857. Hassenstein.)

CENTRAL EUROPE

This designation includes the following major modern political units: Germany, Austria, Switzerland, The Netherlands, Belgium.

1553—Oelinger, Georg. Herbarium des Georg Oelinger. Anno 1553 zu Nürnberg. Edited by Eberhard Lutze and Hans Retzlaff. Salzburg, Akademischer Gemeinschaftsverlag, 1949.

Plate 44 pictures a tomato. The accompanying label lists the names: *Rote Tomate* (*Liebes- oder Goldäpfel.*), *Solanum lycopersicum* (*Mala Aurea seu Poma Amoris.*) The authorship and dates of these names are not clear.

The plates in this modern edition are selections from the manuscript work, *Magnarum medicinae partium herbariae et zoographiae, imagines quamplurimae excellentes: a praeclaro in hoc studii genere viro, Domino Georgio Oelingero*

Norimbergensi, pharmacopola, mercatore et cive, mira perspicuitate picturae et magnus sumptibus in hunc librum relatae, which is preserved (MS 2362) in the Manuscript Collection of the Library of the University of Erlangen. It consists of a series of hand-colored plant illustrations prepared for the Nürnberg apothecary, George Oelinger. The editors note that the work was in preparation for a number of years, and was finally finished for Oelinger about 1553 by a Samuel Quicchelberg.

There seems to be no doubt that tomatoes were known to Oelinger and his illustrators from plants grown in his own garden at Nürnberg. Gesner (see 1561 below) specifically lists Oelinger as one of the German gardeners cultivating this plant.

Whether the plant was grown primarily as a curiosity or for its medicinal properties is not clear. Oelinger was apparently a zealous plant collector, who, in the heyday of plant drugs, might have well mixed his pleasure in collecting rare plants with his business of selling simples. Perhaps his clients were willing to pay dearly for the latest "wonder drugs."

Plate 44, numbered S. 541 in the manuscript, is one of three tomato varieties illustrated. In the complete Oelinger work, in addition to the red variety, two yellow varieties are illustrated (S. 543 and S. 545).

1553—Dodonaeus, Rembertus. *Trivm priorvm de stirpium historia commentariorum imagines ad viuum expressae*. Antverpiae, 1553.

p. 428. This early work lists the Latin, German, and French names for the tomato along with an illustration of the plant. Nothing is said of the uses.

1554—Dodonaeus, Rembertus. *Crüydeboek*. Antwerp, 1554.

pp. 471-472. See the Lyte translation of this work (Great Britain, 1578. Dodoens).

1558—Dodonaeus, Rembertus. *Histoire des Plantes . . . Nouvellement traduite . . . en françois par Charles de l'Ecluse*. Anvers, 1557.

See the Lyte translation of this work (Great Britain, 1578. Dodoens).

1561—Gesnerus, Conradus. *Horti Germaniae*. Argentorati [Strasbourg], 1561.

Reverse side of p. 273. *Pomum aureum vel amoris dictum* . . . ". . . the fruit is odorless, not unpleasant, not harmful in food; the size of a small . . . apple [and] round; often rather large, uneven and lumpy; [the fruit] is gold in one species, red in a second, and in a third white." (Tr.)

Gesner continues, noting that the fruit is easily grown [in Germany], and matures fruit early. The plant is described as flourishing in pots or borders with rich soil and plenty of water.

A list of the "German" gardeners who cultivate this plant is also furnished by Gesner. These include: 1. Öllingerus of Nürnberg; 2. Vuoysselus of Breslau; 3. Petrus Condenbergius of Antwerp; 4. Joachimus Kreichius of Torgau.

Ollingerus (Georg Oelinger), Gesner indicates, had died sometime before the publication of *Horti Germaniae*. In a discussion of prominent German gardeners (p. 243), including those listed above, Gesner reports that Oelinger "... cultivated a garden over a long period of time and with great interest, and he prepared for himself a volume with pictures of plants painted most elegantly ..." (see 1553, Oelinger, above.)

1563—Dodonaeus, Rembertus. Crüjdeboek. Anvers, 1563.

p. 375. See the Lyte translation of this work (Great Britain, 1578. Dodoens).

1574—Dodonaeus, Rembertus. Purgantivm aliarvmqve eo facientivm, tvn et radicvm, conuoluulorum ac deleteriarum herbarum historiae, libri IIII ... Antverpiae, 1574.

p. 364. *De Aurcis Malis*.

"They are frequently sown in gardens ...

"Although they are cold, they are less cold than Mandrake. The apples are eaten by some prepared and cooked with pepper, salt, and oil. They offer the body very little nourishment and that unwholesome." (Tr.)

The reference to the consumption of tomatoes with pepper, salt and oil originated with Matthiolus (see Italy, 1533. Matthiolus). The evaluation of the fruit as cold and offering little nourishment is apparently Dodonaeus' own, and is frequently repeated by later authors.

Dodonaeus includes a mythological note in this section on golden apples: "There are other golden apples of which the poets tell, of the gardens of the daughters of the Hesperides, which were guarded by a dragon which Hercules killed." (Tr.)

1580—Kessler, H. F. "Landgraf Wilhelm IV von Hessen als Botaniker." Program der Realschule zu Cassel. Cassel, 1859.

p. 9. "Ludwig [Count Ludwig von Hessen (Marburg)] had bought on a trip to Heidelberg the seeds of the following plants and sent them on the 29th of February, 1580, to Cassel ... *Poma amoris*." (Tr.)

There seems little doubt but that the tomatoes grown from those seeds were of interest to Wilhelm only as curiosities or perhaps as ornamentals.

1581—de l'Obel, Matthias. Kruidtboek oft beschrÿuinghe van allerleye ghewassen, kruyderen, hesteren, ende gheboomten. Antwerpen, 1581.

pp. 331-333. *Gulden Appelen*.

"This foreign plant is also of double or doubtful nature: that is, of the nature of the Mandrake, the Nightshade, and yellow poppy: therefore it must be placed among these. Another reason it must be placed among these is because some people considered it, as well as the yellow poppy, to be a *Glaucium*, although it cannot be the latter (i.e. the yellow poppy); for no plant can be *Glaucium* if it has yellow juice; and as Dioscorides says no yellow poppy nor any *Cbelidomie* [can be *Glaucium*], on account of their (*exulcererendē*) strength. Nor also can it be placed among the sorts of *Oenanthē*, which is the largest of the herbs which have yellow sap, for this is hot by nature. But rather should this *Glaucium* be the same as the plant which bears golden apples (i.e. the tomato)? This does not seem a sufficiently certain identification either. For it does not have one or two of the signs which

Dioscorides describes (in his discussion of *Glaucium*) i.e. of the sap and the leaves. The sap of the *Glaucium* is very useful for those who have running humours of the eye with heat; the white of the eye becomes grey when it is first put on, wherefore it is called in Latin, *Glaucium*; unless it was so called, as Pliny says, from the leaves which have the color of sea water. It [the tomato] not only drives away the power of superfluous dampness, but it tempers also the heat as has been put to the test by our modern doctors. Yes, it is also very good against wild fire (erysipelas), because it is very cold, diminishing the heat when it is applied. The sap that is drawn from the burning of branches (of *Glaucium*?) which grow in Syria and hot places is not too strong and is also thicker and brighter in color than that from the tomato. The juice of the apples (i.e. tomatoes) especially is watery, thin and yellowish, and like that of melons, and the leaves are also not dissimilar to those of the melon, for they are very long, winged, thick and similar to each other, quick growing and grey of color, cut, hollowed out, and hacked like cauliflower. The whole plant is very succulent and creeps along the earth like wild cucumbers and has the same yellow flowers and upstanding side branches: the fruit is very large and of the size and appearance of an orange, rounded and with furrows running from the stem-end, upwards, sometimes yellow and sometimes bright red like those of the balsam apple or foreign cherry, and containing yellowish, flat seeds. These apples were eaten by some Italians, like melons, but the strong stinking smell gives one sufficient notice how unhealthful and evil they are to eat. But it is emphatically not the *Glaucium* which the Venetians and other apothecaries of Italy use, as the modern herbalists think it is, because the outside of the fruit of that plant (i.e. *Glaucium*) is rosy and the inside yellow, bitter, and with an unlovely smell, thus having all the signs which Dioscorides lists. He lists these characteristics so that it should not be possible for the greedy Syrian Jews to counterfeit the *Glaucium*, as is done with very many other things: that is to counterfeit the smells, the colors and tastes as was done in the time of Dioscorides. Yes, what is more, the tomato can very well be used even if it is not the *Glaucium*; but it should not be considered the *Glaucium* for this reason. What is more, if I wanted to have a good convenient medicine at the beginning of the flux—one which would have a resolving power, I should rather draw-out a sap from a Dewthistle or Goosethistle or a Condrille which is uniquely stinking, milky, and yellowish, and use it unmixd for the things which Dioscorides cures with *Glaucium*, which should do the same good with more safety. For some of these are not very different in appearance and strength from Poppies and *Glaucium*.

"Another kind of *Poma amoris* which comes forth from Spanish seed sown in our gardens has erect stalks, one cubit in height and is similar in appearance to the aforementioned, but is smaller." (Tr.)

Then follows a discussion of the preparation and properties of *Glaucium* for medicinal use, as given by Dioscorides, and the medicinal properties of the plant as stated by Galen.

This Flemish reference is in need of a critical translation.

1583—Dodonaeus, Rembertus. *Stirpium historiae pemptades sex. sive libri XXX*. Antverpiae, 1583.

p. 455. This reference is identical to that contained in the 1574 *Purgantium* of the same author. (See 1574, Dodonaeus, above.)

The 1616 edition of this work (Antverpiae. pp. 457-458) contains essentially the same reference as the 1583 work.

1586—Matthiolus, Petrus Andreae. *Kreuterbuch . . . gemehret vnd verfertiget durch . . . Ioachim Camerarium*. Franckfurt am Mayn, 1596.

pp. 378-379. *Gold öpffel, Poma aurea*. "They have become common in all gardens . . . In Italy the fruit is eaten cooked with pepper, oil and vinegar, but it is an unhealthy food, and gives little nourishment." (Tr.)

The fruit is also reported as efficacious for scabies when treated with oil or macerated in the sun. Uses of the juice of the plant in treating eye diseases, and for erysipelas and hot fluxes are discussed.

The following editions of this work contain a reference essentially identical to that quoted above: 1611—Frankfurt am Mayn. pp. 378-379; 1678—Basel. p. 678.

1586—Camerarius, Ioachim. De plantis epitome vtilissima, Petri Andreae Matthioli . . . Francofvrti ad Moenvm, 1586.

p. 821. *Poma amoris*. "It grows in gardens and likes moist places . . . It is cold and not without bad qualities. The apples are eaten without harm in Italy. They are also macerated with oil and dried in the sun there, or buried in horse manure, in order to anoint scabies, . . . this is highly praised by some." (Tr.)

The Francofurti ad Moenum, 1636, edition of this work also contains the reference quoted above.

1588—Camerarius, Ioachim. Hortvs medicvs et philosophicvs: in quo plvrimarvm stirpivm breves descriptiones. Francofurti ad Moenum, 1588.

p. 130. "*Pomum amoris* or *de oro*, called by the Milanese '*Pomum Indum*,' and by the foreign name '*Tumatle* from the island of Peru.'" (Tr.)

Speaking generally of its uses, Camerarius says that the apples cooked in oil or dried in the sun are effective against scabies. From the context of the 1586 work by the same author (see above), it seems clear that this use is specific for Italy.

1591—Tabernaemontanus, Iacobus Theodorus. Neuw Kreuterbuch. Franckfurt am Mayn, Volume II . . . digerirt vnd vollbracht durch Nicholavm Braun, 1591.

Volume II. p. 464. "These apples have become common in gardens . . . The juice of this fruit is of a quite cold nature. It should not be used internally . . . Some say that the juice is good for St. Anthony's fire and other hot fluxes [when] spread on externally; however, one should take care with it, for it can soon do very great harm." (Tr.)

1601—Schvvenckfelt, Caspar. Stirpium & fossilium Silesiae catalogvs. Lipsiae [Leipzig], 1601.

p. 325. *Poma amoris*. "Its juice reacts strongly against erysipelas, St. Anthony's Fire and other warm fluxes." (Tr.)

The quoted material is probably taken from Pena and de l'Obel (see Great Britain, 1570. Pena). Whether or not this prescription was used in German is unknown.

1604—In a painting by Jan Brueghel the Elder titled "The Gifts of the Earth and Water," now part of the Vienna Art Collection, there appears what may well be a small pear or cherry-shaped variety of tomato. The painting is dated 1604.

1609—Durante, Castor. Hortulus Sanitatis. Das is ein heylasm [es] vnd nützliches Gährtlin der Gesundtheit . . . Nunmehr aber in vnser hoch Teutsche Sprach versetzt durch Petrum Uffenbachium. Franckfurt am Mayn, 1609.

p. 557. *Goldtäpfel*. *Mala aurea*. *Poma aurea*. The reference to the use of

the tomato is a simple translation from the 1585 Italian *Herbario Nuovo* (see Italy, 1585. Durante).

1613—Tabernaemontanus, Iacobus Theodorus. *Neuw vollkommentlich Kreuterbuch . . . Franckfurt am Mayn*, 1613.

Volume II. p. 494. The reference is identical to that in the 1591 edition of the same work with the following pertinent additions:

a. ". . . others use the juice of the plant (*des Krauts*) for the eyes and look upon it as *Glaucium*." (Tr.) [For amplification of the relation between *Glaucium* and the tomato: See Central Europe, 1581. de l'Obel.]

"The apples boiled in oil or well macerated in the sun, are good against scabies (*bissige Ränd*) smeared with it." (Tr.)

b. "In Italy, they eat the fruit cooked with pepper, oil and vinegar, but it is an unhealthy food and of little nourishment." (Tr.)

The Basel, 1664, edition of this work also contains the passages quoted above (*Das ander Theil*. p. 1174).

1635—Nierembergivs, Ioannes Evsebivs. *Historia Natvrae*. Antverpiae, 1635.

p. 319. The fruit is described as being used to make a pickle, and as bringing out the flavor of foods and stimulating the appetite. The leaves are recommended for a remedy for St. Anthony's Fire; vaporized or poulticed they are said to be good for diseases of the eyes and head. It is also a remedy for an upset stomach; and breaks up tumors of the ears when used with salt. The juice is recommended for inflammation of the throat and spreading ulcers. With certain compounds it is good for a children's disease called "*syrrhasin*." With egg white it fights acute fluxes and is good for ear aches. Etc. . . .

1644—Dodonaeus, Rembertus. *Crvydt-Boeck*. Antwerpen, 1644.

p. 750. An adequate translation of this Flemish work could not be obtained. The apples are reported as being cold, but not so cold as Mandrake. Some are reported to eat the apples cooked with oil, pepper and vinegar. It is said to be good for scabies.

1651—Bavhinvs, Ioh., and Cherlerus, Ioh. Hen. *Historia plantarvm vniversalis, nova, et absolytissima cvm consensv et dissensv circa eas*. Ebrodvni, Volume III, 1651.

Volume III, pp. 620-621. "The juice of this plant is very useful for the cure of a rheum or deluxion of hot humours of the eyes which may occasion a glaucoma if not prevented. Not only does it restrain the afflux of the humor, but moderates fever . . . Furthermore, it is very effective against St. Anthony's Fire and erysipelas. The apples are eaten by some Italians just as cucumbers, but the whole plant exhales an evil odor; it is of little food value, and it is not very safely used as food. It yields moreover, very little food to the body, and that evil and corrupt. It is cold, but not so cold as Mandrake. Cooked in oil, it is efficacious against scabies. By a chemical preparation, it yields an oil very proper for the cure of [burnings] . . . This oil, rubbed on the temples and body induces sleep . . ." (Tr.)

1654—Laurembergivs, Peterivs. *Hortivltvra, libris II. comprehensa; . . . Francofurti ad Moenum*, 1654.

Dürkop (see 1907, Dürkop, below) reports that the tomato is not listed in the seventh chapter of the second book of this work, which lists a large number of little-known vegetables.

1663—Becher, Joachim Matthaeus. *Parnassus medicinalis illustratus*. Ulm, 1663.

Dürkop reports the following verse from this work:

"Goldäpfel brauchet man, sie stillen bald den Grind,
Zum Essen innerlich man sie nicht gut befind."

(See 1907, Dürkop, below.)

1666—Chabraeus, Dominicus. *Stirpivm icones et sciagraphia*. Genevae, 1666.

p. 525. The tomato is listed under Class 34: Malignant and Poisonous Plants. In the appendix to the work, on p. 654, the plant is reported to be cold, but not so cold as mandrake, and the nourishment which it furnishes to the body is said to be small and corrupt.

The juice is said to be effective against certain humours, and as a remedy for erysipelas and St. Anthony's Fire. Cooked in oil the fruit is recommended for scabies, and certain chemically prepared oil extracts are said to be a cure for burnings. This same oil applied to the temples and body is reported to induce sleep.

1673—Nylandt, Petrus. *De Nederlandtse herbarius*, of *Kruydt-Boeck* . . . Amsterdam, 1673.

p. 507. *Gulden Appel*. *Appel der Liefde*.

The cooling quality of the plant is discussed, and it is noted that the fruit, cooked in oil, is effective against scabies.

1676—Cause, D. H. *De Koninglycke Hovenier* . . . Amsterdam, 1676.

p. 185. *Appel der Liefde*, *anders Gulde Appel*.

The plant is described in detail and careful directions for its culture are given, but nothing is said or implied concerning its uses.

1682—Munting, Abrahamus. *Waare Oeffening der Planten*. Amsterdam, 1682.

p. 522. *Gouden Appel*. The varieties of love apples are listed and their method of culture is described. Nothing is said of the use of this plant.

1684—Elssholtz, Johann Siegesmund. *Vom Garten-Bau*. 3 Druck. Cölln a. d. Spree, 1684.

The tomato is known to this author only as an ornamental. The plant is described in the second book (The Flower Garden) but it is not mentioned in the fourth chapter of the third book (An Enumeration of Kitchen Fruits)—Dürkop (see 1907, Dürkop, below).

1696—[Matthiolus, P. A.]. *Theatrvm botanicvm*. Das ist: Neu vollkommenes Kräuter-Buch . . . erstens zwar an das Taglicht gegeben von Herren Bernhard Verzascha, anjetzo aber in eine gantz neue Ordnung gebracht . . . durch Theodorvm Zvingervm. Basel, 1696.

pp. 896-897. *Goldäpfel*. "The gold apples are cold and moist in nature; they have a saltpeter-like, volatile, somewhat oily taste, and through this the property to resolve, and to alleviate pains . . . In Italy the gold apple is eaten with pepper, oil and vinegar, but it is an unhealthy food . . .
 "The juice of the plant, freshly pressed and warmed, when dropped in the eyes and covered with a little cloth, cures sharp, running fluxes; it also heals the scabies and the erysipelas when diligently applied . . ." (Tr.)

The plants are reported planted "in our gardens."

1706—Liger, Louis. *Le Jardinier Fleuriste et Historiographe* . . . Amsterdam, 1706.

Volume II. pp. 350-353. The method of cultivation and best mode of use of this plant as an ornamental are discussed in detail.

1715—Elsholz, Johann Siegesmund. *Neuangelegter Garten-bau*. Leipzig, 1715.

p. 94. The tomato is described among annual plants for the flower garden.

1727—Boerhaave, Hermannus. *Historia plantarum, quae in Horto Academico Lugduni-Batavorum crescunt*. Romae, pars I-II, 1727.

Pars secunda. p. 509. "The virtues of this plant are disputed and the controversy has not been resolved; but to me the plant would seem better referred to the poisonous plants than to the medicinal plants, for its seeds when taken upset the stomach and cause faintness and a sort of apoplexy." (Tr.)

1731—Boerhaave, Hermannus. *Historia plantarum, quae in Horto Academico Lugduni-Batavorum crescunt*. Londini, pars I, II, 1731.

Pars secunda. p. 509. The reference is identical to that in the Romae, 1727, edition above.

1744—Zuingerus, Theodorus. *Theatrum botanicum* . . . Itzo auf das Neue übersehen, und mit vielen Beschreibungen und Figuren der Kräuter vermehret durch Friedrich Zwinger, des seel. Authors Sohn, . . . Basel, 1744.

p. 1088. "The gold apples [possess] the property of cooling, of dispersing and of soothing, pains . . .

"The juice, freshly pressed from the plant (*aus dem Kraut*) when dropped into the eyes and bound with a cloth, heals sharp, running fluxes; it also heals *Ueberrothe* and the *wilde Feuer*." (Tr.)

This work also reports that the tomato is eaten in Italy cooked with salt, pepper and vinegar, but adds that it is an unhealthy food.

1748—Möller, Georg F. "Versuch, den Ursprung der Augen in den Gewächsen zu erklären." *Hamburgisches Magazin*. 3rd Band, erstes Stück. Hamburg, 1748.

pp. 119-120, paragraph 24. This article contains a discussion of the so-called "augen" in *poma amoris* or *Lycopersicon*. This may be the first non-taxonomic scientific work involving the tomato.

- 1751—Dale, Samuel. *Pharmacologia, seu manu ductio ad materiam medicam*: . . . Quinta editio, ex scriptis Hermannii Boerhaave . . . Lugduni Batavorum, 1751.

p. 188. It is noted that the fruit is used medicinally, its strength being similar to *Solanum* and *Mandragora* (probably the nightshade and the mandrake). Uses and qualities reported by other authors are listed.

- 1754—Erhart, Balthasar. *Oeconomische Pflanzenhistorie nebst dem Kern der Landwirtschaft Garten- und Arzneykunst*. Ulm and Memmingen, Volume III, 1754.

Volume III. p. 171. The tomato is listed as a poisonous plant in the same category as the nightshade and belladonna.

- 1774—Reuss, Christianus Friedericus. *Compendium Botanices*. Ulm, Stettin, 1774.

p. 211. *Solanum Lycopersicon* . . . "*ad acetaria*."

Apparently *ad acetaria* refers to the use of the fruits with vinegar and oil or as salad (see Harper's *Latin Dictionary*).

- 1776—Onomatologia Botanica Completa. Frankfort and Leipzig, 1772–78. Volume VIII, 1776.

Volume VIII. p. 619. "Their [the tomato's] berries are round, generally furrowed and red, sometimes without furrows or yellow or white. People ascribe to them, especially to the berries, a stupefying power which borders on the fancied strength of the love potion; however, this belief has not been confirmed by actual experience, and since in addition to this, in Italy and India the fruit is preserved with vinegar or in saltwater, and frequently eaten without harm as a salad (*Salat*) or "spice" (*Gewürz*), all of these beliefs appear to be invalidated. One can easily propagate them in the garden through seeds, where they must be kept in pots." (Tr.)

- 1779—Linné, Carl von. *Vollständiges Pflanzensystem nach der 13 lateinschen Ausgabe und nach Anleitung des holländischen Houttuynschen Werkes übersetzt* [von G. F. Christmann und G. W. F. Panzer]. Nürnberg, 1779.

Volume V. pp. 681–683. *Liebes-Aepfel*. "The fruits are thought poisonous by some persons, but are freely eaten in the East Indies; also eaten in Italy with pepper, salt and oil like melons." (Tr.)

- 1784—Plenck, J. J. *Bromatologia seu doctrina de esculentis et potulentis*. Viennae, 1784.

p. 126. The author says that the plant is thought poisonous, but it is his opinion that the fruit can be safely eaten when cooked in sauces.

- 1787—*Salat Gewächse*. Frankfort am Main, 1787.

p. 197. *Solanum lycopersicum*, *Liebesäpfel*. This is one of the plants listed under the heading, "*Salatarten zum Kochen*."

"In Italy and India the fruit is preserved with vinegar and saltwater and frequently eaten without harm as a salad (*Salat*) or 'spice' (*Gewürz*)." (Tr.)

- 1788—Anonymous. "Von den Sommergewächsen." *Journal für die Gärtnerney*. Volume XIII. Stuttgart, 1788.

p. 498. "Several of these summer plants are desirable because of their flowers, others on account of their pretty fruits and seed capsules; a few only because of their distinctly colored foliage are planted in the flower garden, or because of their tenderness in pots. To the second group belong[s] . . . *Solanum lycopersicum* . . ." (Tr.)

p. 513. "*Solanum Lycopersicum* [is also in a special group] which on account of its pretty fruit is planted in pots" (Tr.)

1791—Schkuhr, Christian. *Botanisches Handbuch*. Wittenberg, 1791.

Volume I. p. 145. "These [tomato] fruits are held by some as poisonous. [They are eaten in several ways in various parts of the world, but are grown] as ornamentals in German gardens." (Tr.)

1796—Bechstein, Johann M. *Kurzgefasste Gemeinnutzige Naturgeschichte der Gewächse des In- und Auslandes*. Leipzig, 1796.

Volume I. p. 333. "The fruits are generally considered as poisonous." (Tr.)

The author also reports that the fruit is used in Italy, Portugal, Spain and Bohemia with salt, oil and pepper, also in gravies and sauces to which it gives a pleasant taste.

1804—Willdenow, Carl L. *Anleitung zum Selbststudium der Botanik*. Berlin, 1804.

p. 167. "In our gardens it [the tomato] is planted for the sake of variety. In southern Europe and in America people use the large red fruit prepared in various ways." (Tr.)

1804—Bianchi, —. "Ueber den Anbau und Küchengebrauch der Tomatis, oder Liebesäpfel (*Solanum Lycopersicum* L.)." *Allgemeines Teutsches Garten Magazin*. Volume I. Weimar, 1804.

p. 377. (Extract from a letter from Mr. Bianchi at Rudolfstadt.) "As promised, you are receiving in the accompanying box, several tomato fruits, the seeds of which I brought back from Italy. I have sown them in April, as you have seen for yourself, in the open garden, in good soil and in sunny place, and transplanted them in May . . .

"In Italy and France they are used in the kitchen in the following way: namely, when they are ripe, which one can tell by their red color and softness, they are cooked for about a half hour in a little bouillon or, that lacking, in a little water; crushed and run through a sieve, to free broth from seeds and skin. This broth is used in soups, ragouts, *potagen*, *pasteten*, and other sauces in order to give them an acid flavor.

"The fruits I am sending you are not quite ripe. The ripe fruits can't be sent very well, for through the long journey the inner flesh [of the fruit] turns into juice, and the skin becomes so thin that one can hardly handle it without it bursting, and they are certainly savory!

Bianchi" (Tr.)

A footnote to this letter indicates that the large red-fruited variety has earned a place among the ornamental plants in Germany. It is said to have come to Germany from the south.

1805—*Encyclopedia von Krünitz*. Berlin, 1805.

100th part. This work reports that the tomato is mostly grown for decoration in the garden or in pots. It adds that many people consider it poisonous, but points out that it is eaten elsewhere in the world. Only in recent times, says the Encyclo-

pedia, have the Germans been giving greater consideration to the culture of the tomato as well as to its use in the kitchen.—Dürkop. (See 1907. Dürkop, below.)

1805—B., F. J. "Garten Miscellen." Allgemeines Teutsches Garten-Magazin. Volume II. Weimar, 1805.

p. 294. "... Die Alten schreiben den Aepfelchen einen verliebten Wahnwitz zu."

1809—Dietrich, F. G. Vollständiges Lexicon der Gärtnerei und Botanik. Weimar, 1809.

Volume IX. pp. 318–319. The tomato is described as fairly common in German gardens. The fruits are considered poisonous by some, but in warmer countries, where they attain a great degree of ripeness, they are eaten with oil, salt and pepper and are also used in soups and other dishes.

1821—Land- und Garten Schatz. Stuttgart, 1821.

Dritter Theil. p. 161. *Von einjährigen Gewächsen*. The tomato is listed in this section of the work. Its fruits are described as being used, in part, in the kitchen.

1834—Anonymous. Review of *L'Horticulteur Belge*. Volume I. Brussels, 1833. The Gardener's Magazine, Volume X. London, 1834.

p. 445. "Tomatoes, when ripe, may be preserved a year in a strong solution of salt in water, without boiling, or any culinary preparation whatever. When taken out of the brine for use, they must be steeped some hours in fresh water."

1847—Schnizlein, Adalbert. Die Flora von Bayern. Erlangen, 1847.

p. 201. *Lycopersicum esculentum*. A footnote describes this as an "ornamental" and as "occasionally cultivated plants."

1853—Anonymous. "Notizen." III. Der Liebesäpfel als Pflanze des Küchengartens." Gartenflora. Volume II. Erlangen, 1853.

pp. 248–249. "The love apple . . . belongs to the best-liked plants of the garden in France, Spain, Italy and the greatest part of America. The fruits of this plant are used not only as ingredients in many different kinds of dishes, but they are also brought to the table in the form of compotes and sauces, or mixed with bread as a vegetable. In America they are attributed with strengthening the stomach . . . The taste of this fruit has something peculiar about it, so that one must get used to it, then it belongs to one of the most pleasant dishes. You may now ask why this plant is almost not cultivated in Germany and Switzerland or only as an ornamental. We can give the assurance that the love apple prospers with us and that only ignorance of its useful properties, or the fearful retention of old handed-down prejudices [which hold] that the fruits of the love apple are inedible or even harmful: these are the reasons why it still isn't planted.

"We admit, however, that if the love apple is not properly cultivated its fruits remain small and have a bad taste." (Tr.)

1857—Hassenstein, ———. "Ueber die Benutzung der Liebesäpfel." Gartenflora. Volume VI. Erlangen, 1857.

p. 54. "In many places, particularly in southern lands, the fruits of the *Solanum Lycopersicon* (Love-apple) are used to a considerable extent, partly by

themselves with pepper, oil and salt, partly for sauces. The first use will probably find little [favor] with us; on the other hand, the use for sauces and ragouts is much to be recommended." [A method of preparation designed to cultivate a taste for tomatoes follows.]

1877—Schmidlin, E. *Gartenbuch*. Fourth edition. Edited by Th. Nietner and Th. Rümpler. Berlin, 1877.

p. 449. "This annual ornamental [the tomato] is of great economic importance in southern countries, and has been recently cultivated by us on account of its beautiful fruit which not only displays a bright color, but also can be used as a stewed fruit, in which form it is used as an ingredient in foods and as a sauce, etc." (Tr.)

1879—Rümpler, Th. *Illustrierte Gemuse- und Obstgärtnerei*. Berlin, 1879.

p. 286. "The love apple with its showy fruit is still much too little cultivated in the kitchen gardens of Germany. For the most part, one finds it cultivated as an ornamental, [planted] on slopes or between large boulders where it thrives extraordinarily well and yields many fruit, quite early, especially when planted in southern aspects.

"Most people don't know the right way to . . . [get acquainted] with the splendid fruit of the tomato; usually they let themselves be frightened on the first trial, because of the initial unpleasant smell, reminiscent of the nightshade. But it is a fact that after the first conquest of this fear, it soon finds great favour in food. One should emphasize that dishes prepared out of tomatoes do not speak well in its behalf, because people, as with the eggplant, don't know the right way of preparing them." (Tr.)

1882—Anonymous. "Neue und empfehlenswerthe Pflanzen." *Gartenflora*. Volume XXXI. Erlangen, 1882.

pp. 115-116. *Abgebildet im Kataloge von Chr. Lorenz in Erfurt*. (2) *Lycopersicum esculentum* . . . "It is a generally known plant, used as a kitchen garden plant and also as an annual ornamental. On the basis of the fruit shape I have distinguished three forms . . . :

"a. typicum . . . It is the sort which is found everywhere in cultivation; its fruit is preferred for use in sauces and as a 'spice' for foods, be it in the fresh condition or preserved. Earlier the fruit was used chiefly only in France, but now they are generally used, especially in restaurants.

"b. cerasiforme (*Kirschenartiger Liebesapfel*) . . . It is used more as an ornamental than as a plant for the kitchen garden.

"c. pyriforme (*Birnförmiger Liebesapfel*) . . . It is still infrequent in culture." (Tr.)

1900—Hegi, Gustav. *Illustrierte Flora von Mittel-Europa*. V Band, 4 teil. München, 1927.

p. 2608. "This South American plant, especially during the last decade, has been frequently cultivated with us in the numerous cultivated forms, for its edible fruits." (Tr.)

1907—Dürkop, Wilhelm. "Ein Beitrag zur Geschichte der Tomate." *Naturwissenschaftliches Wochenschrift*. Volume XXII. No. 35. Jena, September 1, 1907.

pp. 548-550. This author presents a brief survey of the literature pertinent to the history of the origin, development, cultivation, and use of the tomato.

FRANCE

1558—Dodonaeus, Rembertus. *Histoire des Plantes . . . Nouvellement traduite . . . en François per Charles de l'Ecluse*. Anvers, 1558.

See the Lyte translation of this work (Great Britain, 1578. Dodoens).

Just how much this French translation of the original Flemish edition of Dodoens' *Cruydeboek* (Antwerp, 1554) reflects conditions in France is doubtful. Both author and translator, though Flemish by birth, were extremely cosmopolitan; yet there is no evidence that their work applies beyond the borders of Flanders.

1582—Estienne, Charles, and Liebault, Jean. *L'Agriculture et Maison Rustique*. —, 1582.

p. 241. See the English translation of this work (1600. Stevens, below).

The tomato is not mentioned in the 1567, Paris, or 1572, Montluel, editions of the work.

1587—Dalechamps, Iacques. *Historia generalis plantarum, in libros XVIII . . . Lvgduni [Lyon], 1587.*

p. 628. *Pomum Amoris, sive Aureum*. (See 1615, Dalechamps, below.)

1600—Stevens, Charles, and Liebault, John. *Maison Rustique, or The Countrey Farme*. Tr. into English by Richard Surfleet. London, 1600.

p. 253. Opposite marginal note "Golden Apples."

"Within this small time there hath been seen a plant somewhat like unto apples of love egg plant, bearing a round fruit like an apple, divided upon the outside as a melon is with furrows; in the beginning it is green, but afterwards when it cometh to ripeness, it becometh somewhat golden and sometimes reddish. This plant is more pleasant to the sight than either to the taste or smell, because the fruit being eaten provoketh loathing and vomiting."

Note the resemblance of the first part of this reference to Matthiolus, 1554. (See Italy, 1544. Matthiolus.)

The London, 1616, and Rouen, 1658, editions of this work carry the same reference.

1615—Dalechamps, Iacques. *Histoire generale des plantes, contenant XVIII livres . . . faite Française par M^e Iean des Movlins*. Lyon, 1615.

p. 533. *Des Pommes d'Amour ou Pommes d'Or*. "They grow readily in the garden from seed . . . The apples, like the entire plant, are cold; however, a little less than the Mandrake; wherefore it is dangerous to use. However, some eat the apples cooked with oil, salt, and pepper. They give very little nourishment to the body, and that bad and corrupt . . ." (Tr.)

The following editions of this work contain the reference quoted above: 1587, Lugduni [Lyon]. p. 628 (see 1587, Dalechamps, above); 1653, Lyon. p. 533.

1619—de Serres, Olivier. *Le théâtre d'agriculture*. 1619.

"Their fruits [the tomato] are not good to eat." The author says that the plants are commonly used in France for covering garden houses and arbours.—Dürkop. (See Central Europe, 1907. Dürkop.)

1739—Chomel, J. B. *Catalogus plantarum officinalium secundum earum facultates dispositus*. Parisiis, 1739.

p. 110. *Pomme Dorée, ou Pomme d'amour* is listed in a section of the catalog title, "*Plantae Narcoticae*."

1739—Chomel, J. B. *Abregé de l'Histoire des Plantes Usuelles*. Cinquieme edition. Paris, 1739. Three volumes.

Tome second. p. 789. "This plant is about of the same quality as the mandrake, but for internal use, less dangerous; for in some parts of Europe, among others in Italy, its fruit is eaten preserved with vinegar, or salt or pepper; it is a bad enough food. I know of persons who steep the fruit in olive oil which they then use for contusions, tumors, rheumatism, and sciatica. It is a good enough *resolutif* and anodyne. The juice of the entire plant is used externally in inflammation of the eyes and other parts; one applies it in fomentations; one can use it in cataplasms like the leaves of the ordinary morelle." (Tr.)

1750—D., M. C. *Chef de Cuisine de M. le Prince de *** Dictionnaire des Alimens, Vins et Liqueurs*. Paris, 1750.

pp. 101–105. On these pages are several recipes involving the use of tomatoes.

1760—Bois, Désiré. *Les Plantes Alimentaires chez tous les Peuples et à travers les Ages*. Paris, 1927.

Volume I. pp. 323–331. It is reported that in the catalogue of seeds of the House of Andrieux Vilmorin, the tomato was still classed under the heading "ornamental plants." Not until the 1778 catalogue was it admitted to the ranks of vegetable seeds.

1763—Liger, Louis. *Le Jardinier Fleuriste*. Paris, 1763.

p. 178. (See Central Europe, 1706. Liger.)

1770—Buc'hoz, P. J. *Traité Historique de Plantes que croissent dans la Lorraine et les Trois Evêchés*. Paris, 1770.

Volume X. p. 397. *Pomme d'amour* . . . The medicinal qualities of the plant are described, and the author adds that "some eat the fruits in salads with salt, oil, pepper and vinegar, but," he notes, "they are of little nourishment and bad juice." (Tr.)

1770—Buc'hoz, P. J. *Dictionnaire Raisonné Universel des Plantes, Arbres et Arbustes de la France*. Paris, 1770.

Volume III. p. 42. *Pomme d'amour* . . . "People regard its fruit as poisonous and narcotic; they make little use of them, cultivating them only for the beauty of their berries." (Tr.)

1778—(See 1760, Bois, above.)

1783—Le Bon Jardinier, *Almanach pour l'Annee M.DCC. LXXXIII*. Paris, 1783.

p. 64. *Tomate. Pomme d'amour. Solanum Lycopersicon*.

Brief cultural directions are given. Sauces are said to be made from the fruit.

The plant is listed among the kitchen garden vegetables.

1785—Miller, Philip. *Dictionnaire des Jardiniers*. Translated from the eighth edition of Philip Miller's 'Gardeners Dictionary.' Paris, 1785.

Volume IV. In alphabetical sequence under *Lycopersicon*. The reference is essentially the same as that in the English seventh edition of 1759. (See Great Britain, 1759. Miller.)

1785—Le Berryais, L. R. *Traité des Jardins*. Nouvelle ed. Paris, 1785.

Volume II. p. 397. "The fruit when fully ripe develops an agreeable acid. It would be dangerous to make use of it before it has acquired this acidity."

1789—Rozier, François, Abbé, editor. *Cours Complet ou Dictionnaire d'Agriculture*. Paris, 1789.

Volume VIII. p. 177. *Pomme d'amour ou Tomates*. "The fruits when quite ripe are used in sauces for all kinds of foods, and the expressed juices are preserved for winter use by the addition of salt and a little vinegar. Seasoned with oil, vinegar and salt, the fruits form a delicate and refreshing food . . . In Italy, in Spain, in Provence, and in Languedoc, the fruit of the tomato is very much sought after." (Tr.)

1792—Walters, Johann Jacob. *Gartenkunst*. Stuttgart, 1792.

p. 118. (See Italy, 1792. Walters.)

1794—*Dictionnaire des Plantes Usuelles*. Paris, 1794.

Volume VI. p. 145. The reference is essentially identical to that contained in M. Chomel's *Abregé de l'Histoire des Plantes Usuelles*. Paris, 1739. (See 1739, Chomel, above.)

1797–1798—Lamarck, J. B. A. P. M., chevalier de. *Encyclopédie Methodique. Botanique*. Paris, 1797/1798.

Volume IV. p. 287. *Morelle pomme d'amour . . . tomato*. "Cultivated in Portugal, Spain, and southern France. Fruits used in sauces and when young, conserved in vinegar. When one eats too many of them, he experiences a slight sharp and stinging taste." (Tr.)

1799—Jolyclerc, N. *Phytologie Universelle*. Paris, 1799.

Volume IV. p. 214. *Pomme d'amour*. "The fruits of the *Lycopersicon* are suspected to be poisonous. People believe these plants to be narcotic, as the *Solanums* and the Mandrake; they are very little used in medicine. The fruits give off, it is true, a disagreeable odor; however, the Italians eat, with impunity, quantities of them cooked in butter. This is a proof that the cooking removes from them the narcotic and poisonous agent." (Tr.)

1801—Boutelou, Claudio, and Boutelou, Estéban. *Tratado de la Huerta*. Madrid, 1801.

pp. 375-383. (See Spain, 1801. Boutelou.)

1802—Dumont de Courset, G. L. M., Baron. *Le Botaniste Cultivateur*. Paris, 1802.

Volume II. p. 130. "*S. Lycopersicum* is cultivated in southern France for its fruits from which are made soups that have the color of the juice of the 'écrevisse'." (Tr.)

1802—Anonymous note. *The Cultivator*. New Series. Volume IX. Albany, N. Y., 1852.

p. 381. (See U. S., 1802. Anonymous.)

1804—Bianchi, —. "Ueber den Anbau und Küchengebrauch der Tomatis, oder Liebesäpfel (*Solanum Lycopersicum* L.)." *Allgemeines Teutsches Garten-Magazin*. Volume I. Weimar, 1804.

p. 377. (See Central Europe, 1804. Bianchi.)

1822—Loudon, J. C. *An Encyclopaedia of Gardening*. London, 1882.

p. 763. (See Great Britain, 1822. Loudon, below.)

1822—Albert, B. *Manuel Complet d'Économie Domestique*. Second edition. Paris, 1822.

p. 7. A recipe for *Marmelade des Tomates*.

p. 11. A recipe for *Sauce Tomato*.

p. 284. A recipe for preserving tomatoes.

1825—Noisette, Louis. *Manuel Complet du Jardinier*. Paris, 1825.

Volume II. p. 446. *Tomate*. "Everybody today knows the use of its [tomato's] red fruit, which is round or oval, smooth or furrowed, according to variety."

1825—Archambault. *Le Cuisinier Economie*. Third edition. Paris, 1825.

p. 265. *De la Pomme-d'amour ou Tomato*. "The chief use one makes of it is in sauces; and I will indicate the way I have seen them prepared in Provènce." (Tr.)

A recipe for *Pommes d'amour Farcies* follows.

p. 357. A recipe for preserving tomatoes.

1828—Descourtilz, M. E. *Flore Pittoresque et Medicale des Antilles, ou Traite des Plantes Usuelles*. Paris, 1828.

Volume VI. p. 95. *Morelle Pomme-d'Amour*. (*Anti acoustique émolliente*.) "The tomato is cultivated in America and in Europe, particularly in Portugal, in Spain and in the central part of France. The resources which it offers to the culinary art in the preparation of ragouts and 'coulis,' have given it admittance to all the vegetable gardens in the vicinity of Paris. Its paste is conserved for the winter, by means of drying; then, when the vegetable resources are limited, in the middle of the winter, the tomato sauce appears on our tables in a thousand ways—to serve in beef

or mutton soups, to be associated with codfish and many other varieties of fish. One eats it in the colonies with piment and other aromatics to prevent inertia in the stomach. One preserves tomatoes in vinegar while they are young. Its culture demands a rich soil and humidity . . ." (Tr.)

Its juice is described as being used macerated in oil and applied to contusions, rubbed in oil on rheumatic parts or applied to inflammations of the eyes and ears. Its leaves are said to be used in a cataplasm. The pulp is recommended for other eye inflammations.

1828—Anonymous. "Notes and Reflections made during a Tour through Part of France and Germany in the Autumn of the Year 1828." The Gardener's Magazine. Volume VII. London, 1831.

pp. 9-10. "December 24, 1828. The forcing department of the Versailles kitchen garden is not without interest . . . Kidney beans were in a growing state, and a stock of young tomato plants were ready to transplant into their pots to fruit during the winter, the fresh fruit being wanted throughout the year for soups, stews and sauces . . . some pits contained excellent lettuces; and we were told that, between the pits and open gardens, kidney beans, lettuces and tomatoes were supplied every day in the year."

1829—Loudon, J. C. An Encyclopaedia of Plants. London, 1829.

p. 160. (See Great Britain, 1829. Loudon.)

1841—Russell, J. W. "On the Culture of the Tomato and Eggplant." Magazine of Horticulture. Volume VII. Boston, New York; 1841.

p. 97. (See U. S., 1841. Russell.)

1842—Anonymous. "The Tomato and its Uses." The Cultivator. Volume IX. Albany, N. Y., 1842.

p. 167. (See U. S., 1842. Anonymous.)

1845—Cosson, E., and Germain, E. E. Flora Descriptive et Analytique des Environs de Paris. Paris, 1845.

Volume I. p. 274. The tomato is listed and described as being "frequently cultivated in kitchen gardens."

1848—Dictionnaire Universel d'Histoire Naturelle. Dirigé par Charles d'Orbigny. Paris, 1848.

Volume XII. p. 600. *La Tomate Comestible* . . . "This plant today is one of the most common plants in our kitchen gardens . . . Everybody knows the daily use which one makes of these fruits, on account of their juice with its agreeable acidity, which is put into nearly all dishes as a seasoning. One uses the juice principally in its fresh state when the plant bears and ripens fruit, that is to say, during a large part of the summer and until frost.

"But one also uses extracts more or less concentrated, which one reduces to the state of a dry paste for the needs during the rest of the year." (Tr.)

1882—Anonymous. "Neue und empfehlenswerthe Pflanzen." Gartenflora. Volume XXXI. Erlangen, 1882.

pp. 115-116. (See Central Europe, 1882. Anonymous.)

1856—Moitessier, Albert. Essai sur les propriétés des Solanées et sur leurs principes actifs. Montpellier, 1856.

p. 64. "The Tomate is largely used in France both as food and seasoning and no ill effects are observed from it; nevertheless it is found that the use of these fruits, especially when overripe, is sometimes followed by colic or diarrhoea. The active principle appears to be located in the seeds, or the pulp which surrounds them." (Tr.)

1900—Curé, J. B. J. *Les Jardiniers de Paris et leur Culture à travers les Siècles*. Paris, 1900.

p. 209. "The Tomato is a relatively new plant in France, although undoubtedly grown in the gardens of the great and rich people long before it was raised commercially." (Tr.)

GREAT BRITAIN

This designation includes the following major political units: England, Ireland, and Scotland.

1570—Pena, Petrus, and de l'Obel, Matthia. *Stirpium adversaria nova* . . . Londini, 1570.

pp. 108–109. (See Central Europe, 1581. de l'Obel.)

(The reference to the above edition of this work is essentially similar to that in the first paragraph of the quoted material in the 1581, *Kruidtboeck*. The 1576 Antwerp edition of the *Stirpium Adversaria nova* is identical to the London 1570 edition, as is the 1605 London edition.)

1578—Dodoens, Rembert. *A nieuwe herball, or historie of plantes*: . . . First set fourth in the Dutche or Almaine tongue, by that learned D. Rembert Dodoens . . . and nowe translated out of the French into English, by Henry Lyte Esquier. London, 1578.

pp. 439–440. *Of Amorous Apples or Golden Apples*. "This is a strange plant and not found in this country except in the gardens of some herborists, where as it is sown . . . The complexion, nature and working of this plant is not yet known, but by that I can gather of the taste, it should be cold of nature, especially the leaves, somewhat like unto the Mandrake, and therefore also it is dangerous to be used."

This reference seems to have been translated and published without essential alteration from the de'Eluse French version (Antwerp, 1557) of Dodoens' *Cruydeboeck* (Antwerp, 1554.)

1586—Dodoens, Rembert. *A new herball or historie of plantes*: . . . First set fourth in the Douch or Almaine tongue, by that learned D. Rembert Dodoens . . . and now first translated out of the French into English, by Henry Lyte Esquier. London, 1586.

p. 508. With respect to the sections quoted, this reference is identical to that contained in the 1578 edition of this work. (See 1578, above. Dodoens.)

1597—Gerarde, John. *The Herball or Generall Historie of Plantes* . . . London, 1597.

p. 275. "Apples of Love do grow in Spain, Italy and such hot countries from whence myself have received seeds for my garden where they do increase and prosper.

"It is sown in the beginning of April in a bed of hot horse dung after the manner of musk melons and such like cold fruits . . .

"The golden apple with the whole herb itself is cold, yet not fully so cold as Mandrake, after the opinion of Dodonaeus; but in my judgement it is very cold, yea perhaps in the highest degree of coldness; my reason is because I have in the hottest time of the summer cut away the superfluous branches from the mother root, and cast them away carelessly in the allies of my garden, the which (not withstanding the extreme heat of the sun, the hardness of the trodden allies, and at that time when no rains at all did fall) have grown as fresh where I cast them as before I did cut them off; which argueth the great coldness contained therein. True, it is that it doth argue also a great moisture wherewith the plant is possessed, but as I have said, not without great cold, which I leave to every man's censure.

"In Spain and those hot regions, they used to eat the apples, prepared and boiled with pepper, salt and oil; but they yield very little nourishment to the body and the same naught and corrupt.

"Likewise they do eat the apples with oil, vinegar and pepper mixed together for sauce to their meat, even as we in these cold countries do mustard."

Gerarde is said to have relied heavily upon the *Pemptades* of Dodoens (see Central Europe, 1583. Dodonaeus). Certainly there are echoes from that work in this reference; nevertheless, it is substantially original. It is definitely known that Gerarde grew the tomato in his famous garden at Holborn (see 1599, below).

The 1633 and 1636 editions of this work (pp. 345-346) contain essentially the reference quoted above.

1599—*Catalogus Arborum, Fruticum ac Plantarum tam Indigenarum quam Exoticarum*, in *Horto Johannis Gerardi cuius & Chirugi Londinensis Nascentium*. Londini, 1599.

p. 16. This catalogue lists two varieties of the Apple of Love, the red and yellow. There is in the British Museum a unique copy of a 1596 edition of the catalogue of the plants in Gerarde's garden which the bibliographer has not seen.

1600—Stevens, Charles, and Liebault, John. *Maison Rustique, or the Countrie Farme*. Tr. into English by Richard Surflet. London, 1600.

p. 323. (See France, 1600. Stevens.)

The London, 1616, edition of this work contains the same reference (p. 253).

1622—Gunther, Robert T. *Early British Botanists and their Gardens*. University Press, Oxford, 1922.

p. 50. "John Goodyer in 1622 (March) received seeds of 22 garden plants from Coys, including two kinds of 'apples of love' or tomatoes."

The "Coys" referred to is a William Coys whose garden at Essex was said to rival that of Gerarde.

p. 379. According to a notation next to *Pomum amoris parvum* in Goodyer's list of plant names, Coys grew this variety of tomato in his garden.

What use either of these gentlemen made of the plants or fruit is not known.

1629—Parkinson, John. *Paradisi in Sole*. London, 1629.

pp. 379-380. *Pomum Amoris*. Love Apples. "Although the beauty of this plant consisteth not in the flower, but fruit, yet give leave to insert it here, lest otherwise it have no place; wherof

there are two especial sorts, which we comprehend in one chapter, and distinguish them by *maius* and *minus*, greater and smaller: yet of the greater kind we have nourished up in our gardens two sorts, that differ only in the color of the fruits and nothing else . . .

"They [Great Apples of Love (of) the ordinary red sort and the Yellow Amorous Apples] grow naturally in the hot countries of Barbary and Ethiopia; yet some report them to be first brought from Peru, a Province of the West Indies. We only have them for curiosity in our gardens and for the amorous aspect or beauty of their fruit . . .

"In the hot countries where they do naturally grow, they are much eaten of the people, to cool and quench the heat and thirst of their hot stomachs. The apples, also boiled, or infused in oil in the sun, are thought to be good to cure the itch, assuredly it will allay the heat thereof."

The *minus* variety may be our common cherry tomato (*L. esculentum*, s. sp. *Galeni*).

Parkinson's reference to the tomato as a cure for the itch is not original with him. It appears as early as Pena and de l'Obel, 1570 (see above).

1640—Parkinson, John. *Theatrum Botanicum*. London, 1640.

pp. 352 and 354. *Poma amoris* . . . Apples of Love . . . "(It) groweth in those easterly countries of Egypt, Syria, Arabia . . . The golden apples or apples of love are cold and moist, more than any of the former, and therefore are less offensive; these are eaten with great delight and pleasure in hotter countries, but not in ours, because their moisture is flashy and insipid for want of sufficient heat of the sun in their ripening."

1653—Culpeper, Nicholas. *The English Physitian enlarged*. London, 1653.

Redcliffe N. Salaman, in *The History and Social Influence of the Potato* (University Press, Cambridge, 1949) points out (p. 108) the omission of the potato, the jerusalem artichoke and the tomato from the Culpeper herbal. Says Salaman: "We may, I think, safely assume that not one of the three plants was sufficiently accessible as to be worth discussing in a book primarily devoted for the use of the ordinary intelligent household."

When the tomato does appear in one of the later editions of this work (see 1790, Sibly, below) profound medicinal properties are attributed to it.

1660—Sharrock, Robert. *The History of the Propagation and Improvement of Vegetables*. Oxford, 1660.

p. 4. Apples of Love are listed in a catalogue of plants that can be increased by seeds.

1665—Rea, John. *Flora seu de Florum Cultura*. London, 1665.

p. 196. *Pomum amoris* . . . "These plants are received only for the beauty of the Apples or Berries as they are commonly called, the flowers being not considerable. Sow in beginning of April and water, or else winter will take them."

1673—Ray, John. *Observations made in a Journey through part of the Low Countries, Germany, Italy, and France*. London, 1673.

pp. 406-407. (See Italy, 1673. Ray.)

1683—Sutherland, James. *Hortus Medicus Edinburgensis, or a Catalogue of the Plants in the Physical Garden at Edinburgh*. Edinburgh, 1683.

p. 322. Lists the red and gold apples of the love. The red variety is described

as having medicinal uses, although they are not specifically stated. The gold form is described as having no medicinal value.

1686—Raius, Joannes. *Historia Plantarum*. London, 1686.

Volume I. p. 675. "Sown in our gardens . . . The juice of this plant is very useful for the cure of a rheum or defluxion of hot humour of the eyes which may occasion a glaucoma if not prevented. However, it not only stops the afflux of the humour, but moderates and allays the inflammation . . .

"The apples are eaten by some in Italy prepared with pepper, salt and oil, as we eat cucumbers."

Ray also points out that the whole plant smells bad and is not very safely used as a food. The juice, according to him, is unpleasant and the nourishment the fruit offers the body is corrupt.

He adds that the fruit cooked in oil is effective against scabies and that by chemical preparation it yields an oil effective for burnings.

1710—Dale, Samuel. *Pharmacologia, seu Manuductio ad Materiam Medicam*. Iterata editio. Londini, 1710.

p. 270. *Poma amoris*. It is described as sown in gardens, flowering in summer. The fruit is the part of the plant which is used medicinally, its virtues being similar to *Solanum* and *Mandragora* (probably nightshade and mandrake).

1710—Salmon, William. *Botanologia*. The English Herbal or, History of Plants. London, 1710.

pp. 29-30. Of Love Apples. "They grow naturally in hot countries, as in Ethiopia, Barbary, Egypt, Syria, Spain, Italy, and other hot countries: some report they were first brought to us from Peru; and I have seen them grow in Carolina which is the south-east part of Florida; but with us in England they grow only in gardens, where being nourished up, they bring forth their fruit to perfection . . .

"The whole plant and apples are cold and moist, almost in the fourth degree; but not so cold as mandrakes. They are cephalick, stomatick, nephritick, and uterine; of an attenuating, cleansing, repercussive, and anodine quality; and operate only as alteratives . . . They are peculiar to allay the heat of inflammations, but more especially of an erysipelas . . .

"The shops keep nothing of this plant; but you may have from it, 1. the apples themselves. 2. the juice. 3. an essence. 4. a cataplasm. 5. an oil. 6. a balsam for wounds . . .

"The apples. In Spain, and those hot countries, they use to eat the apples prepared and boiled in vinegar, with pepper and salt, and served up with oil, and juice of lemons: likewise they eat them raw, with oil, vinegar, and pepper, for sauce to their meat, as we here do cucumbers; but they yield not much nourishment, but only please and cool or quench the heat and thirst of hot stomachs.

"The juice. Applied upon inflammations, but especially bathed upon an erysipelas, and linen cloths wet in the same, laid thereon, abate the inflammation, and take away the preternatural heat.

"The essence. It represses vapors in women, is good against fits of the mother, opens the obstructions of the urine, taking away the heat and scalding thereof; is good against sand, gravel, and the stone, and gives ease in all pains proceeding from a hot cause. Dose from j to ij ounces.

"The cataplasm. It is good against the headache, megrim, gout, sciatica, and all pains whatsoever proceeding from a hot and dry cause: in outward applications it ought to be renewed twice a day.

"The oil. It cures all manner of burnings, and scaldings, whether of fire, water, oil, lead, etc. and has the virtues of the cataplasm, and may be annointed upon those places where a cataplasm cannot be applied.

"The balsam. It is a singular good thing to cool inflammations in wounds and ulcers, heal all sorts of burnings and scaldings, cleanse old running sores, and to give ease in the gout, pain in the

back, or any other part proceeding from vehement hot and fiery hot humors: it admirably heals wounds, and when cleansed, ulcers also, after the manner of preparations from *all-beals*.

"A special note. It appears that this plant abounds with a vast humidity; for in the hottest time in summer, the superfluous branches being cut off from the mother root, and carelessly cast away in the allies of the garden, though at a time when no rain shall fall, yet will they grow as fresh, as if they had not been cut off; which shows indeed the exceeding moisture of the herb.

- 1719—Tournefort, J. P. *The Compleat Herbal of Mr. Tournefort*. (Translated from the Latin with additions from Ray, Gerard, Parkinson, and others.) London, 1719.

Volume I. pp. 214–215. "The juice of this plant is very useful for the cure of rheum or defluxion of hot humors of the eyes, which may occasion a Glaucoma if not prevented: for it not only stops the afflux of the humour, but moderates and allays the inflammation: it is no less beneficial in a St. Anthony's Fire, and such like inflammatory distempers . . .

"The fruit boiled in oil is efficient for the cure of the itch and by a chemical preparation yields an oil very proper for the cure of burnings.

"The Italians eat the apples as we do cucumbers with pepper, oil and salt. Some eat them boiled; but considering their great moisture and coldness, the nourishment they afford must be bad."

- 1721—Miller, Joseph. *Botanicum Officinale, or a Compendious Herbal*. London, 1721.

p. 32. *Amoris Pomum* . . . "In Italy they eat these Love Apples with oil and vinegar, as cucumbers are eaten here, but they are seldom eaten with us, being of the nature of the other *Solanums*; and therefore only used outwardly in cooling and moistening applications, in inflammations and erysipelas; and its juice especially is commended in hot defluxions of rheum upon the eyes. It is but seldom used."

- 1724—Bradley, Richard. *A General Treatise of Husbandry and Gardening*. (For the Months of August and September, and the remaining part of the second year.) London, 1724.

p. 181. "To Mr. Bradley. Sir. According to your desire, I send you a Catalogue of such curious Flowers as blow in my Garden from July to compleat the Year. I am,
Your humble Servant,
Thomas Fairchild."

- p. 183. In the list which Mr. Fairchild sends along we find "Tree Love Apples, two sorts."

———. *A General Treatise of Husbandry and Gardening*. (For the months of June and July, the second year.) London, 1724.

- p. 80. Under the heading "Flowers for the month of July," Love-Apples are listed.

- 1728—Bradley, Richard. *Dictionarum Botanicum*. London, 1728.

Volume II. In the appendix of this work: *Pomum amoris*: "The Love Apple is of various kinds, of the nightshade tribe: the fruits of all of them are hot and invigorating; the Capsicum and the Borongella are of this race; and are used in hot countries, in sauces to their meats. Every sort that I have seen makes an agreeable plant to look at, but the fruit of most of them is dangerous. They may, however, be raised from seed, for the sake of their pretty appearance, by sowing their seeds in March or April."

- 1730—Index Plantarum Officinalium, quas, ad Materia Medicae Scientiam Promovendam in Horto Chelseiano. Societas Pharmaceutica Londinensis. Londini, 1730.

p. 70. *Pom Amoris*. Fruits. This is another case where the tomato was grown for its fruits which were used medicinally.

1731—Miller, Philip. *The Gardener's Dictionary*. First edition. London, 1731. Folio.

In alphabetical sequence under *Lycopersicon*, Miller describes a technique for growing the plants for the flower border, and for potting. Concerning the latter, he says:

"These plants which are placed in pots should be often watered, otherwise they will come to little (for they are very droughty plants); but when they are planted in a rich moist soil, they will grow to a prodigious size and produce large quantities of fruit, which in autumn when they are ripe, make an odd figure; but the plants emit so strong an effluvium as renders them unfit to stand near an habitation, or any other place that is much frequented; for upon their being brushed by the clothes they send forth a very strong disagreeable scent.

"The Italians and Spaniards eat these apples as we do cucumbers with pepper, oil and salt; and some eat them stewed in sauces, etc., but considering their great moisture and coldness, the nourishment they afford must be bad. The first of these plants [a yellow variety] is the sort directed for medicinal use by the College in their Dispensatory."

The following editions of this work also contain the reference quoted above: 1737—Third edition. Folio; 1741—Second edition. Octavo (three volumes abridged); 1748—Third edition. Octavo (three volumes abridged).

1731—Boerhaave, Hermannus. *Historia plantarum, quae in Horto Academico Lugduni-Batavorum crescunt* . . . Londini, pars I, II, 1731.

Pars Secunda, p. 509. The reference is identical to that in the Romae 1727 edition (see Italy, 1727. Boerhaave).

1732—Meager, Leonard. *The New Art of Gardening with the Gardener's Almanack*. Second edition. London, 1732.

p. 123. In the Garden Almanack (for the Flower Garden) for March, the author directs that *Pomum amoris* be sown in the hotbed. They are also listed under flowers blowing in September (p. 133) and in October (p. 135).

1734—Miller, Philip. *The Gardeners Kalendar*. London, 1734.

p. 59. Love Apples are listed among the plants to be sown in the hot-bed during March.

p. 130. Love Apples are listed among the plants to be transplanted during June from the hot-bed into the borders of the flower garden.

1737—Blackwell, Elizabeth. *A Curious Herbal containing Five Hundred Cuts of the most Useful Plants which are now used in the Practice of Physick*. London, 1737.

Volume I. Facing Plate 133. "It is sown in gardens and flowers in July, the fruit being ripe in September. Love Apple, outwardly applied, is esteemed cooling and moistening, good for inflammations and erysipelas; the juice is commended in hot defluxions of rheum upon the eyes. In Italy they eat them with oil and vinegar as we do cucumbers."

1739—Rand, Isaacus. Horti Medici Chelseiani Index Compendarius. Londini, 1739.

p. 122. Five varieties of tomatoes are listed. Presumably they were being cultivated as medicinal plants.

1752—Miller, Philip. The Gardener's Dictionary. Sixth edition. London, 1752.

In alphabetical sequence under *Lycopersicon*. Several important additions appear in this edition:

"The Italians and Spaniards eat these apples as we do cucumbers, with pepper, oil and salt; and some eat them stewed in sauces, &c., and in soups they are now much used in England, especially the second sort, which is preferred to all the other. This fruit gives an agreeable acid to the soup; though there are some persons who think them not wholesome; from their great moisture and coldness, and that the nourishment they afford must be bad. They are called by the Portugese and Spaniards, *Tomatoes*. The first of these plants [a yellow variety] is the sort directed for medicinal use by the College in their Dispensatory."

This is the first documentation of any extensive culinary use of the tomato in Great Britain. The 1759 (seventh) edition of this work is identical in respect to the passages quoted. Extensive notes on the cultivation of the plants have, however, been added.

Miller describes how the seeds should be sown and the young plants cared for:

"In May, these plants should be transplanted either into pots filled with rich light earth or into borders near walls, pales, or hedges, to which their branches may be fastened to support them from trailing on the ground, which they otherwise will do, and then the fruit will not ripen, so that where these plants are cultivated for the sake of their fruit, they should be planted to a warm aspect, and the branches regularly fastened as they extend that the fruit may have the advantage of the sun's warmth to forward them, otherwise, it will be late in the season before they are ripe, and they are unfit for use before; but when the plants are brought forward in the spring, and thus regularly trained to the south sun, the fruit will ripen by the latter end of July, and there will be a succession of it till the frost kills the plants.

"Some persons cultivate these plants for ornament, but their leaves emit so strong offensive an odour on being touched, which renders them very improper for the pleasure garden, and their branches extend so wide and irregular as to render them very unsightly, for they cannot be kept within bounds, especially when they are planted in good ground, therefore the borders in which these plants are placed for their fruits must not be too rich, for in moderate soil they will be not so luxuriant and more fruitful."

1755—Hill, John. The Usefull Family Herbal. Second edition. London, 1755.

p. 11. Apples of Love. "The plant is a kind of nightshade, we cultivate it in gardens . . . The Italians eat the fruit as we do cucumbers. The juice is cooling; it is good externally used in eruptions on the skin and in diseases of the eyes, where a sharp humour is troublesome."

1765—Mr. Stevenson. The New and Complete Gardener's Kalendar. Dublin, 1765.

p. 128. March. Work to be done in the Kitchen Garden. "Sow . . . the seed of capsicum for pickling, and tomatoes for soups on a hot-bed."

p. 135. May. Work to be done in the Kitchen Garden. "Transplant for the end of the month, and in favourable weather, the tomatos for soups, and the capsicums for pickling, which have been raised upon hot-beds. Plant the tomatos near a wall, pale, hedge, or espalier to which the plants when grown must be fastened . . ."

This is the sole reference to the tomato in Ireland in the bibliography. The work seems to have certain similarities to the 1759 edition of Miller's *Gardeners Dictionary* (q. v.) as far as this plant is concerned.

1790—Sibly, E. *Culpeper's English Physician and Complete Herbal*. London, 1790.

pp. 227-228. Love-Apple. "It groweth into a tree of a reasonable height, with large dented leaves, cut in upon the edges, and of a pale green colour. The blossoms are large and white, which falling, the fruit follows . . . The tree is a native of Ethiopia; but it is planted in the gardens of many of the curious in this kingdom . . . The apples of love are under Venus; yet are they cold and moist in an extreme degree. They are oligotrophic and cachochymic; yet in hot countries, they are eaten as a sauce, boiled with pepper, salt and oil. The juice boiled with uxungia to a salve, heals all inflammations and burnings; and the leaves boiled with oil-olive, till crisped, then strained and afterwards boiled with wax, rosin, and a little turpentine, to a salve, are an infallible remedy for old sores and ulcers of the privities, or for wounds and ulcers in other parts of the body, coming of heat, or the vicious humours of the blood."

An illustration of the plant and fruit appears in plate No. 8, facing page 223.

The description of the plant, while it apparently intends to describe a tomato, is grossly incorrect. One can only surmise the effectiveness of the ointments which Mr. Sibly prescribes. (See 1653. Culpepper, above.)

1797—Mawe, Thomas. *Every Man his Own Gardener*. London, 1797.

p. 157. March. Work to be done in the Kitchen Garden. "About the middle of this month is the time to sow some tomatoes or love-apple seed; the fruit or apples of these plants are in some families much used in soups, and are also often used to pickle, both when they are green and when ripe."

Love-apples are also listed several times as plants suitable for the flower garden.

1801—Boutelou, Claudio, and Boutelou, Estéban. *Tratado de la Huerta*. Madrid, 1801.

pp. 375-383. (See Spain, 1801. Boutelou.)

1807—Martyn, Thomas. *The Gardeners' and Botanists' Dictionary of the late Philip Miller, corrected and newly arranged with additions*. London, 1803-07. Four volumes.

Volume II, Part II (1807). In alphabetical sequence under *Solanum*. Except for the change in the genus name, this edition adds nothing new to the older editions of Miller (see 1741, 1748, 1752, 1759, above).

1819—Sabine, Joseph. "On the Love Apple or Tomato . . . Transactions of the Royal Horticultural Society. Volume III. London, 1819.

pp. 342-354. "The great use which has been made of the Tomato of late years for culinary purposes, has occasioned it not only to be grown in private gardens, but has also rendered it an object of cultivation for the market of the metropolis. Possessing in itself an agreeable acid, a quality very unusual in ripe vegetables, it is quite distinct from any other product of the kitchen garden. It appears to be used, when fresh, in a variety of ways in soups and sauces; and its juice is preserved for winter use, in the manner of ketchup."

1820—Phillips, Henry. *Pomarium Britannicum*. London, 1820.

pp. 235-40. Reports (p. 236) that "The fruit has long been used by the wealthy Jew families in this country and within these last few years it has come into great use with all our best cooks, as it possesses in itself an agreeable acid, a very unusual quality in ripe vegetables, and which makes it quite distinct from all garden vegetables that are used for culinary purposes in this country. It makes a good pickle, and is preserved in various ways for winter use, and is made into a kind of ketchup also. When boiled in soups and sauces, it imparts an acid of a most agreeable flavour; it is also served at the table boiled or roasted and is sometimes fried with eggs. Love apples are to be seen in great abundance at all our vegetable markets; but I do not find that they are used by the middle or lower classes of English families who have yet to learn the art of improving their dishes with vegetables.

"Mr. John Wilmot, of Isleworth, states that in 1819, he gathered from six hundred plants, four hundred and thirty-three bushels, and that he then had many to spare. He adds that the plants produced from twenty to forty pounds weight each, and that some of the apples measured twelve inches in circumference."

1822—Loudon, J. C. *An Encyclopaedia of Gardening*. London, 1822.

p. 763. Section XI. Plants used as Preserves and Pickles. Paragraph 1404: "When ripe the fruit which has an acid flavor is put into soups and sauces, and the juice is preserved for winter use like ketchup; it is also used in confectionary, as a preserve; and when green as a pickle. Though a great deal used in England in soups and as a principal ingredient in a well known sauce for mutton; yet, our estimation and uses of the fruit is nothing to those of the French and Italians, and especially the latter. Near Rome and Naples, whole fields are covered with it, and scarcely a dinner is served up in which it does not in some way or other form a part . . ."

The above reference also appears in the 1827 edition of this work.

1826—Anderson, John. "... Receipts . . . procured for us by Mr. John Anderson F. H. S., Gardener to the Earl of Essex at Cassiobury, from an eminent French cook lately in the Earl's service." *The Gardener's Magazine*. Volume I. London, 1826.

p. 353. Seven recipes are listed including:

1. Tomata sauce for cold meat.
2. Potted tomata.
3. Tomatas quite plain [these are actually cooked].
4. Tomatas with gravy.
5. Tomatas pickled.
6. Towit of tomatas [a jam-like substance].
7. Tomatas as a dried fruit.

1827—M'Murtrie, Wm. "On the Utility of gathering unripe Tomatoes, and maturing them on Shelves in Hot-houses." *The Gardener's Magazine*. Volume VII. London, 1831.

p. 195. The author, who was gardener to Lord Anson, Shugborough Gardens, describes a technique for ripening green tomatoes by picking them and storing them on shelves in hot-houses. He adds, "The consumption at Shugborough is about two bushels a year, which are produced by about 80 plants." (Read April 5, 1827.)

1829—Loudon, J. C. *An Encyclopaedia of Plants*. London, 1829.

p. 160. *S. Lycopersicum*. "It is cultivated extensively around Naples and Rome for the use of the berry in sauces, stewing and soups. It is one of the most common articles used in Italian cookery and makes an excellent sauce for fish, meat and general purposes. Its use for sauce is greatly on the increase, and it is cultivated to a considerable extent near London, against walls and artificial banks, being raised on a hot-bed, and transplanted like other tender annuals."

The following editions of this work also contain the reference quoted above:
1841—London; 1855 and 1866—Edited by Mrs. Loudon. London.

1831—Phillips, Henry. *The Companion for the Orchard*. London, 1831.

pp. 225–227. The reference in this work is essentially identical to that in the *Pomarium Britannicum* of the same author. (See 1820 above. Phillips.)

1831—S., E. "On a mode of cultivating the Tomato, so as to make sure of ripening the Fruit without artificial Heat." *The Gardener's Magazine*. Volume VIII. London, 1832.

p. 174. "Sir, It having fallen to my lot to be placed in situations requiring a good supply of love apples, I have been induced to try a variety of methods to bring them to the greatest degree of perfection . . . [and if people follow this technique] we shall not (at least in this part of the country) hear of people being obliged to cut the fruit and hang it up in a warm room to ripen. [Sow the seeds indoors and grow the plants as large as possible before planting them out.] By growing the tomato plant as large as possible before planting out, they have the advantage of the summer for ripening, and by planting only one in each place, the small place usually left between the fruit trees may be used for them. Whereas by growing three in a pot (as is usually practised) they make a great deal of room and require continual cutting which causes them to push afresh, etc. I am, Sir, yours, & c. E. S. Tottenham, Dec. 24, 1831."

At least on the big estates, love apples seem to be a dietary item of some importance. Gardener E. S. seems a little annoyed at Mr. M'Murtrie's suggestion that one should ripen green tomatoes indoors (see 1827, above).

1832—Anonymous. "Covent Garden Market." *The Gardener's Magazine*. Volume VIII. London, 1832.

p. 624. On September 17, 1832, tomatoes were selling for 2s 6d per ½ sieve at the Covent Garden Market. They are listed under the heading: "Stalks and Fruits for Tarts, Pickling, etc."

1834—Anonymous. "On the Different Modes of Budding; and of Herbaceous, or Summer Grafting." (From *L'Horticulteur Belge*.) *The Gardener's Magazine*. Volume X. London, 1834.

p. 312. ". . . Tomatoes may be grafted in this manner on potatoes, and it is said that potato plants thus treated produce good crops both of potatoes and tomatoes."

This grafting experiment still remains an item of popular interest.

1836—Dickens, Charles. *The Posthumous Papers of the Pickwick Club*. Charles Scribner's Sons. New York, 1924.

Part II. p. 88. "And now, gentlemen, but one word more. Two letters have passed between

these parties, letters which are admitted to be in the handwriting of the defendant, and which speak volumes indeed. These letters, too, bespeak the character of the man. They are not open, fervent, eloquent epistles, breathing nothing but the language of affectionate attachment. They are covert, sly, underhanded communications, but, fortunately, far more conclusive than if couched in the most glowing language and the most poetic imagery—letters that must be viewed with a cautious and suspicious eye—letters that were evidently intended at the time, by Pickwick, to mislead and delude any third parties into whose hands they might fall. Let me read the first:—'Garraway's, twelve o'clock. Dear Mrs. B.—Chops and Tomato sauce. Yours, PICKWICK.' Gentlemen, what does this mean? Chops and Tomato sauce! Gentlemen, is the happiness of a sensitive and confiding female to be trifled away, by such shallow artifices as these?"

1840—Dewey, Chester. Report on the Herbaceous Flowering Plants of Massachusetts. Cambridge, 1840.

p. 166. (See U. S., 1840. Dewey.)

1842—B., C. "On the Culture of the Tomato or Love Apple (*Lycopersicum esculentum*) so as to insure a Crop in cold Situations and dull wet Seasons." The Gardener's Magazine. Volume XVIII. London, 1842.

pp. 277-279. "Of this plant which is a native of South America, and was introduced into this country in the year 1596, there are three or four varieties . . . Of these, the red-fruited is held in the highest estimation, on account of its superior size and beauty. It is cultivated [in several places in Europe] as well as in our own country, making an excellent sauce for fish, meat, &c. It is cultivated to a considerable extent near London, there being scarcely a gentleman's garden, either large or small, in which the love-apple may not be found growing and bearing fruit in abundance; although very often the fruit will not come to maturity . . . owing in a great measure . . . to the seeds not being sown early enough . . ."

The author then describes a method of giving the plants an early start by sowing them indoors in December and transplanting them. But evidently he had had trouble convincing others of the value of this technique. He comments:

"You will be surprised to hear that there are gardeners, even in these days of cheap knowledge, who will not profit by the labour of others either by reading or observing, but must go on in their own often obsolete way, yet such is the fact; for if anything new and rather out of the common way be shown them in the shape of drawings, articles, on culture, etc., they will flatly tell you they are deceptions, and that they want no 'new-fangled systems.' Many gardeners that have seen my love-apple plants this year will say: 'Bless me! you are precious soon with the tomatoes. Why, they will be a great deal too soon,' etc. I say: 'How so? What time do you sow your seed?' 'Oh! not before March or April.' 'What sort of a crop had you last year?' I ask. 'Oh! I got none, they did not ripen; they were too late.' So you see, they will show their own blindness. 'Well! will you have a few plants?' 'Oh! yes, I will take a few; I begin to see you are right.' Now it is evident by my neighbors' own account that the method is worth a trial; because last year they had no fruit themselves, and I had a good crop, and a few to spare to give away. I am sorry that some are so very sceptical, and think too much of their own ways; to such I would say, 'Give things a fair trial, and prove before you condemn.'"

1858—Hogg, Robert. The Vegetable Kingdom and its Products. London, 1858.

p. 547. The Love Apple or Tomato. "The plant has a disagreeable and nauseous odor, and its juice evaporated over the fire produces a vapor so powerful as to cause vertigo and vomiting. A fruit is extensively used in Spain, Italy and France, and its cultivation is increasing in England and will become wider when people discover the agreeable ways in which the fruit can be prepared."

1870—Brotherston, R. P. "About Tomatoes." Garden. Volume 83. Feb. 22, 1919. London.

p. 86. ". . . The old fashioned ribbed tomatoes, one of the greatest of which was named Trophy, were atrocious in flavour and in smell. Not only has the tomato been improved as a cropper and in the beautiful smoothness and rotundity of its fruit, but along with these, the

sweetness of its flesh as opposed to its former peculiarly nasty taste is very remarkable. Nearly fifty years ago I had charge of a collection of tomatoes in pots . . . It may be interesting to note that plants from seeds sown in January were gathered in May. But the crops were small. How little the tomato was appreciated may be gathered from the fact that the crop was almost entirely consumed—raw—by myself. Nobody ate raw tomatoes in those days!"

The consumption of the tomato raw must be much more recent in England than its use as a cooked vegetable. It may well be possible that few if any people ate the tomato raw in England at this late date.

1880—Hall, Charles A. "Lore of the Tomato." *The Gardeners' Chronicle*. Volume 126. Third Series. London, 1949.

p. 54. "When I was a small boy, say seventy years ago, it was commonly said that a taste for tomatoes had to be acquired—no one liked them at the first eating. Actually, they never appeared on the table in my home and there was only one garden in our village where they were grown as a novelty. I saw them in all their glory of red and yellow fruitage and felt that fruits so attractive in appearance must be good to eat. I was tempted to help myself to one and alas! I fell. Great was my disgust when I came to taste it, for it was utterly nauseous to me and I quickly spat my mouthful out.

"My next taste of tomatoes was in Canada, where one bought them by the measure, not weight. I found I liked them and, on very hot days, bought them by the quart for a few cents, feeling their juice to be a good thirst quencher.

"Talking with folk of my own generation, I find that most of them in their youth looked upon taste for the fruit as one to be acquired. A lady acquaintance used to tell me how she, with a few friends, was shown over the gardens of a nobleman's estate in the north on which there was a house with ripe tomatoes. The head gardener told the party they might eat as many of the fruits as they liked, but not one of them got beyond the first mouthful. The good man evidently banked on the 'acquired taste' idea and he had gathered that none of his visitors had tasted tomatoes before. That would be about seventy-five years ago."

1886—De Candolle, A. *Origin of Cultivated Plants*. Second edition. London, 1886.

pp. 290–292. Pertinent references from this work are included in this bibliography.

1925—Dicks, S. B. "The Tomato." *The Gardeners' Chronicle*. Third Series. Volume 77. London, 1925.

p. 98. "The atmosphere of mistrust which surrounded this fruit in the time of Lyte (1578) still persisted at the end . . . of two centuries, and some traces still remain."

1943—Luckwill, L. C. "The evolution of the cultivated tomato." *Journal of the Royal Horticultural Society*. Volume 68. London, 1943.

pp. 19–25. Pertinent references from this work are included in this bibliography.

1943—Luckwill, L. C. *The genus Lycopersicon*. An historical, biological and taxonomic survey of the wild and cultivated tomatoes. *Aberdeen University Studies*, No. 120. Aberdeen, 1943.

Pertinent references from this work are included in this bibliography.

1948—Jenkins, J. A. "The origin of the cultivated tomato." *Economic Botany*. Volume II, Number 4. October–December, 1948.

pp. 379-392. The author presents a brief survey of the early history of the tomato, primarily to establish the origin of the plant. In the course of the article, several references to the use of the tomato are made; these all appear in this bibliography.

SPAIN AND PORTUGAL

1581—de l'Obel, Matthias. *Kruidtboeck*. Antwerpen, 1581.

pp. 331-333. (See Central Europe, 1581. de l'Obel.)

1597—Gerarde, John. *The Herball or Generall Historie of Plants*. London, 1597.
p. 275. (See Great Britain, 1597. Gerarde.)

1707—Sloane, Hans. *A Voyage to the Islands Madera, Barbados, Nieves, S. Christophers and Jamaica*. London, 1707.

Volume I. pp. 237-238. (See West Indies, 1707. Sloane.)

1710—Salmon, William. *Botanologia. The English Herbal or, History of Plants*. London, 1710.

pp. 29-30. (See Great Britain, 1710. Salmon.)

1731—Miller, Philip. *The Gardener's Dictionary*. First edition. London, 1731.

The 1731, 1737, 1748, 1752, and 1759 editions of this work contain the same reference concerning the use of the tomato in Spain and Portugal. (See Great Britain, 1731 and 1752. Miller.)

1783—Bryant, Charles. *Flora Diaetica: or History of Esculent Plants . . .*
London, 1783.

p. 212. In section of work entitled "Foreign Berries, often raised in Gardens and Stoves." "*Solanum Lycopersicum* . . . These berries are in such esteem both among the Portuguese and the Spaniards that they are an ingredient in almost all their soups and sauces, and are deemed cooling and nutritive."

1784—Quer, Joseph. *Flora Española*. Volume V. Madrid, 1784.

p. 386. "It is cultivated in great abundance on the truck farms and irrigated fields in all the provinces and lands of our peninsula; it occurs in great abundance and is sown every year. It flowers by March and April in Andalusia, Murcia and Valencia, so that in these provinces, they enjoy the fruit nearly all year, even in the winter, and I am a witness to having eaten them fresh and recently harvested from the plant in the months of January and February . . .

"The majority of the ancient authors and some modern ones, especially those in the north, still do not agree about the good qualities of the tomatoes. On the contrary, they are of the opinion that they ought to be included in the ranks of the poisonous plants rather than among the medicinal plants. But the experience in our peninsula shows that this is all wrong; and although in Italy, and particularly in Naples, they are eaten with dressing in salads, among us, they are without comparison with other vegetables during their season, for use in sumptuous and delicate dishes, seasoning the most delightful foods and forming a delicious sauce which gives an agreeable flavor to *cocida* and other dishes. The common people use them in cooked dishes and, besides that, eaten in salad and raw with a little salt; they are in general the light breakfast for the field workers in Mancha and Valencia; and a fried dish of tomatoes and peppers forms the afternoon meal and likewise the supper dish of the poor who get fat and strong in the tomato season. Certainly in Spain they are not harmful and are used by the rich and the poor, and neither the former who eat them because they like them nor the latter who eat them out of necessity have suffered the slightest detriments to their health." (Tr.)

A footnote to the statement, apparently added by someone else, states: "I think that the somewhat excessive eulogy with which the author has paid tribute to the tomato deserves some moderation. Its use, particularly when it is abundant, produces diarrhoeas, fevers, indigestions, and other diseases." (Tr.)

1787—Townsend, Joseph. *A Journey through Spain in the Years 1786 and 1787*. London, 1792.

Volume I. p. 183. A tomato is listed as one of the plants which the author had obtained dried from the herbarium of a young Barcelonan. He said that he had not seen this plant on any of his walks.

Volume III. p. 271. In a chapter describing Valencia, he describes tomatoes as one of the crops grown in the vicinity of the city. It is described as an "intermediate" crop.

1792—Walters, Johann Jacob. *Gartenkunst*. Stuttgart, 1792.

p. 118. (See Central Europe, 1792. Walters.)

1794—Barham, Henry. *Hortus Americanus*. Kingston, Jamaica, 1794.

p. 92. (See West Indies, 1794. Barham.)

1796—Bechstein, Johann M. *Naturgeschichte des In- und Auslandes*. Leipzig, 1796.

Volume I. p. 333. (See Central Europe, 1796. Bechstein.)

1797—Russel, Alexander. *Naturgeschichte von Aleppo*. Göttingen, 1797.

Volume I. p. 113. Footnote. (See E. Mediterranean, 1797. Russel.)

1801—Boutelou, Claudio, and Boutelou, Estéban. *Tratado de la Huerta*. Madrid, 1801.

pp. 375–383. "Tomatoes are cultivated in all the truck farms and gardens of Spain with notable abundance; in foreign countries it is still a little-known plant. However, in the last ten years, the truck farmers in the vicinity of London and Paris have planted some beds on their grounds, and people are beginning to take a fancy to them. Because it is a species of the genus *Solanum* it has been admitted to gardens and fields with reluctance, being suspected of participating in the same qualities, . . . poisonous to men, by which the majority of the species which compose that family in the plant kingdom are distinguished and known.

"Medical and economic uses. They are eaten raw with salt; but it is a cold food and not very healthy. They are also eaten cooked in various ways. Its daily use is for sauces and preserves to which it gives a pleasant acid taste.

"Some prepare them in vinegar with salt and black pepper, making some cuts in them so that the vinegar will penetrate well. Prepared in this way, they last for a long while without spoiling, but not too ripe tomatoes should be used [in this way]. The fruit of the tomato excites the appetite and comforts the stomach suffering from excess heat." (Tr.)

1811—Sickler, J. V. *Garten-Handlexikon*. Erfurt, 1811.

(See Central Europe, 1811. Sickler.)

1826—Anonymous note. *American Farmer*. Volume VIII. Baltimore, 1826.

p. 279. (See U. S., 1826. Anonymous.)

1828—Descourtilz, M. E. Flore Pittoresque et Médicale des Antilles, ou Traité des Plantes Usuelles. Volume VI. Paris, 1828.

p. 95. (See France, 1828. Descourtilz.)

1853—Anonymous. "Notizen." Gartenflora. Volume II. Erlangen, 1853.

pp. 248-249. (See Central Europe, 1853. Anonymous.)

EASTERN MEDITERRANEAN

This designation includes the following major political units: Greece, Syria, Iran, Egypt, and Cyprus.

1640—Parkinson, John. Theatrum Botanicum. London, 1640.

pp. 352-354. (See Great Britain, 1640. Parkinson.)

1710—Salmon, William. Botanologia. The English Herbal or, History of Plants. London, 1710.

pp. 29-30. (See Great Britain, 1710. Salmon.)

1797—Russel, Alexander. Naturgeschichte von Aleppo. Göttingen, 1797.

Volume I. p. 113. Footnote. "The love apple or tomato which one formerly grew only in pots like other flowers, have quite recently been grown in large quantities and brought into the bazaars; their use was introduced to the French by an Englishman who stayed in Spain and Portugal for some time; the fruit is called by the natives, French Badinjan; it is Linnaeus' *Solanum Lycopersicum*." (Tr.)

1837—Baumann, Eugene Achille. "Notes taken from the Narrative of a Horticultural Journey in Greece, during the Summer of 1837." The Gardener's Magazine. Volume XV. London, 1839.

p. 102. "Their [Greeks] culinary vegetables consist generally of young pumpkins, not yet fully grown, *Cucurbita Lagenaria*?, with other species and varieties; the fruits and seeds of *Hibiscus esculentus* are used exactly as peas and kidneybeans are here. Their taste is rather sour and very refreshing; tomatoes (*Solanum Lycopersicum*) are used all over the country and in almost every dish."

1839—Anonymous. "How to preserve Tomatoes for the Winter." The Cultivator. Volume VI. Albany, N. Y., 1839-1840.

p. 183. (See U. S., 1839. Anonymous.)

1840—Fiedler, Karl G. Uebersicht der Gewächse Königreichs Griechenland. Dresden, 1840.

p. 757. Says that they grow in practically every garden.

1865—Kotschy, Th. Die Insel Cypern. Wien, 1865.

p. 288. *Lycopersicum*. Common.

1876—Ascherson, P. "Die Garten von Esneh in Aegypten." Gartenflora. Volume XXV. Erlangen, 1876.

p. 71. "In a garden close by the landing place El Homrah at Siut . . . bloomed *Narcissus poeticus* . . . Of vegetables, I found in the (*chbedivischen*) garden in Esneh: tomatoes (Arab: *tomat*), egg plant (Arab: *badingan*), etc."

1912—Muschler, Reno. *A Manual Flora of Egypt*. Berlin, 1912.

Volume II. p. 843. "Cultivated everywhere abundantly; often naturalized."

1952—Interview with Mr. Frank Khinoo.

Mr. Khinoo was a native of Rezhiah (Urmiah) Province of Iran. His family were Assyrian Christians associated with the produce business in the ancient horticultural center of Gulpashan. He left as a young man in 1918. Mr. Khinoo has had a long association with the growing of vegetables.

He reports that tomatoes are commonly used in northwest Persia, dried into a paste. The process by which the paste is made is as follows: the tomatoes are smashed, skinned, boiled and spread out flat and dried in the sun until gummy. Pieces are cut off of this paste and used for winter cooking. The paste is called "*moorabba bedumdban*." Tomatoes are also eaten in a common eggplant dish.

AFRICA

(Exclusive of Egypt)

1671—Addison, Lancelot. *An Account of West Barbary*. Oxford, 1671. In Pinkerton, John. *A General Collection of . . . Voyages and Travels . . .* London, 1814.

Volume XV. p. 405. "Besides the salad ordinary in other countries, they have one sort rarely to be met with in Europe which they call by a word sounding Spanish *Tomatés*. This grows in the common fields, and when ripe is plucked and eaten with oil; it is pleasant, but apt to cloy."

1710—Salmon, William. *Botanologia. The English Herbal or, History of Plants*. London, 1710.

pp. 29–30. (See Great Britain, 1710. Salmon.)

1720—Shaw, Thomas. "Travels or Observations relating to Barbary." London, 1757. In Pinkerton, John. *A General Collection of . . . Voyages and Travels . . .* London, 1814.

Volume XV. p. 601. "Endive, cress, chervil, spinageall, all sorts of beets with the young shoots of the wild and garden artichoke are in season from October to June; and then follow during the rest of the summer calabashes, mellow-keeh, bedinjanms, and tomatas; each of them in its turn gives a relish to their soups and ragouts."

1776—Proyart, —. Abbé. "History of Loango, Kakongo and other kingdoms in Africa." Paris, 1776. In Pinkerton, John. *A General Collection of . . . Voyages and Travels . . .* London, 1814.

Volume XVI. p. 554. "The tomato is a small fruit the size of a cherry; the negroes use it as an ingredient in their ragouts as we use onions in ours, but it is from motives of economy and for the sake of filling up, rather than seasoning;

this fruit absolutely insipid of itself, imbibes the taste of the sauce without communicating any of it whatever; it grows on a shrub."

1778—De Cassini, —. (A Voyage to California by Mons. Chappe D'Auteroche) also A Voyage to Newfoundland and Sallee by Monsieur De Cassini. London, 1778.

p. 186. "These gardens at Sallee likewise abound with water melons, calabashes, meringens, tomatoes and other productions peculiar to hot climates."

1853—Hiern, William Phillip. Catalogue of the Plants collected by Dr. Friedrich Welwitsch in 1853-61. London, 1898.

Volume I. p. 744. *Lycopersicon esculentum*. Barro do Bengo, Loanda, etc. "Wild but not indigenous, very plentifully occurring in all neglected, formerly cultivated places and about dwellings, also at the stations (called *Quilombo*) of the migratory negroes, from the Atlantic shore to Condo, in fields between Quicune and Cacuaco.

"The plant is especially frequent about the fundas (caravan encampments) in company with *Cleome* and *Psidium*."

1858—Livingstone, David. Missionary Travels and Researches in South Africa. New York, 1858.

p. 712. (From the section of the work, bearing the title "On the Quilimane and Zambesi Rivers, from the Journal of the late Capt. Hyde Parker, R.N., H.M. Brig 'Pantaloen'.")

p. 712. "At one village, about 17 miles up in the eastern bank [of the Zambesi] and distinguished by being surrounded by an immense number of bananas and plantain-trees, a great quantity of excellent peas are cultivated; also cabbages, tomatoes, onions, . . ."

1869—Schweinfurth, Georg. The Heart of Africa. Three Years' Travels and Adventures in the Unexplored Regions of Central Africa from 1868-1871. New York, 1874.

Volume I. p. 121. Along the Gazelle, "I can only boast of having naturalized in this district of Central Africa two plants as representative of the culture of Europe—the sunflower and the tomato."

p. 215. "Here too, I trained some tomatoes and sunflowers which ever since have been quite naturalized in this part of Africa."

p. 253. "The tomato may well be considered a cosmopolite, making itself at home in all warmer latitudes, but previously to my arrival it had not found its way into this region."

p. 528. "I was the first to introduce tomatoes into the district of the Gazelle, and I have no doubt that ere long they will be extensively grown even in the most central localities of Africa."

1872—Oliver, D., and Grant, J. A. "The Botany of the Speke and Grant Expedition." Transactions of the Linnean Society of London. Volume XXIX. London, 1875.

Part I, 1872. p. 119. "The natives at 7° 27' S. lat. did not know the use of the fruits [of the tomatoes] and were surprised to see us eat them. Frequently met with in the countries between Unyoro and Ugogo."

1873—D'Alviella, Goblet. Sahara and Lapland. Travels in the African Desert and the Polar World. London, 1874.

p. 35. Tomatoes are listed among the crops grown in the gardens in the province of Wady-Suf. These gardens are evidently planted in the bottoms of excavations which are carefully walled to keep them from being filled with blowing sand.

1895—Engler, A. *Die Pflanzenwelt Ost Afrikas und der Nachbargebiete*. Berlin, 1895.

Part C. p. 356. "Now cultivated everywhere."

Part B. p. 223. "This native American plant is not only cultivated everywhere in the tropics, but has also spread widely in the wild form with little round, hardly cherry-size, brick-red fruits; the wrinkles in the fruits of the larger cultivated forms are not original, but the result of breeding . . .

"They are found everywhere in Africa where civilization has reached; according to Emin, they reached the Equatorial Provinces through the Danagla (Dongolanische Händler); they were still not known to the Dinka- and the Dschuristämmen in Schweinfurth's time (1870); but Junker found them in Bahr el Ghazalgebiet and also among the Mombutu, cultivated with success by the Mohammedans there.

"In German East Africa, they have penetrated likewise along the path of the Arab traders, and also along the caravan routes. Emin found them in Unyoro in 1877, growing wild in large masses; Stanley mentions them on his Livingstone Expedition as cultivated by the Arabs of Tabora; Baumann mentions them at Kilimani-Urambo; Grant found them at Ugogo; however, the natives of 7° 37' south latitude still, at that time, didn't know the fruits. One finds them, according to Emin, in Ussui; Stuhlmann found them in Kisinga (westward from Victoria Nyansa) as remnants of the Arab settlement; likewise Kafuro in Karagwe, and also at Kawalli in the ruins of the Arab colony. Naturally, they have been cultivated more recently at missions and military stations. It is noteworthy that the plants have not had a more rapid introduction among the negroes. On the coast it had disseminated itself more freely, for example, in Tangagebiet (Baumann); Bondei (Baumann) and Usambara (Holst); furthermore at Pare (Baumann), even if infrequently, as in Tawetta. It is also found in Usambara everywhere in the plantations and in the vicinity of the houses on the waste places, growing half wild; for this reason, it is seldom planted; it is in that place, of a quite round form, the size of *Mirabellen*, and ripens from May to October; it is brought there in baskets for sale, to be eaten raw or as a side dish with rice or *Ugallit*. Also on the coast, the round *Mirabellen* form is dominant; in Tanga it is used a great deal for a sauce and as a salad, one can obtain ten or twelve tomatoes for one pesa.

"The fruit is not only used raw or cooked for soups, sauces and as a vegetable, but also put in vinegar when unripe to make an excellent, healthy provision.

"They are excellently adapted as vegetables for cultivation at temporary stations; one can provide himself easily with good travel rations with the tomato; after cooking them, one runs them through a sieve or cloth; then boils them down with cayenne pepper; squeezes them out; forms cakes; and allows them to dry for days, with abundant turning, in the sun. (Junker. III. p. 559)." (Tr.)

1905—Gleichen, —, editor. *The Anglo Egyptian Sudan*, London, 1905.

Volume I. p. 161. In a discussion of the southwestern Sudan (*Bahr el Ghazal*), it is reported that the Nyam Nyams grow tomatoes as a food plant.

1906—Johnston, Berry. *Liberia*. London, 1906.

Volume II. p. 901. "These people [the Spanish and Portugese] who were the great benefactors of East and West Africa as regards the introduction of new food products, also brought to Liberia the pineapple, guava, tomato, capsicum (red pepper), sweet potato, maize, cassava (*Manihot*), papaw, the orange and lime and the short form of the banana."

p. 990. The tomato is listed among the cultivated plants.

1929—Broun, A. F., and Massey, R. E. *Flora of the Sudan*. London, 1929.

p. 311. The "*Banaduro*" or "*Tomatum*" is reported as grown throughout the country.

NORTHERN EUROPE

This designation includes the following major political units: Sweden, Latvia, and Norway.

1862—Schübeler, F. C. *Die Culturpflanzen Norwegens*. Christiana, 1862.

p. 81. "Only admirers, who either find pleasure in the plant itself or who like the taste of the fruit in sauces, bother with their culture." (Tr.)

1867—Andersson, Nils J. *Aperçu de la Végétation et des Plantes Cultivées de la Suède*. Stockholm, 1867.

p. 75. *Pomme d'amour*. Listed as a cultivated plant under the heading "Condiment Plants."

1952—Interview with Dr. V. Muhlenbach.

Dr. Muhlenbach is a native Latvian and a trained botanist. He reports that the tomato was not eaten in Latvia to any extent before World War I. After the war, it began to be cultivated in large quantities. He thinks it is possible that large numbers of Latvian refugees returning to their homes from Russia brought the habit of using the tomato with them. The tomato was not regarded as poisonous, but rather the taste was thought disagreeable. It is now eaten sliced with onions or preserved as a sauce.

In south Russia at the time of the first World War, Dr. Muhlenbach saw large fields of the plants. They are called tomat in Latvian and pomidor in Russian.

WEST INDIES

1707—Sloane, Hans. *A Voyage to the Islands Madera, Barbados, Nieves, S. Christophers and Jamaica*. . . London, 1707.

Volume I. pp. 237-238. "This [the tomato] grows in several places about the Town of St. Jago de la Vega, and in Guanaboa, near Mrs. Guy's House, in her Plantation, but I cannot be positive that 'tis wild. It grows likewise in the Caribes.

"They are eaten by some here, are thought very naughty, and yielding little Nourishment, though they are eaten either boil'd or in a sauce by the Spaniards."

He then proceeds to quote several authors on the tomato.

1750—Hughes, Griffith. *The Natural History of Barbados*. London, 1750.

p. 148. "They [tomatoes] are generally made use of, boiled in broth. These were brought hither by his excellency Governor Worsley, from Portugal."

1779—Oldendorf, C. G. "Einige Nachrichten zu der Naturgeschichte der Westindischen Inseln." Edited by Jacob Bossart. *Sammlungen zur Physik und Naturgeschichte*. Volume I. Leipzig, 1779.

p. 234. "The *Solanum lycopersicum* or tomato bears a fruit which, when put on meat and in soup, gives them a flavour." (Tr.)

1798—Manning, Robert, Jr. History of the Massachusetts Horticultural Society, 1829–1878. Boston, 1880.

p. 40. (See U. S., 1798. Manning.)

1828—Descourtilz, M. E. Flora Pittoresque et Médicale des Antilles, ou Traité des Plantes Usuelles. Paris, 1828.

Volume VI. p. 95. (See France, 1828. Descourtilz.)

ASIA

This designation includes the following major political units: India, Burma, Indo China, Malaya, and Dutch East Indies.

1747—Rumphius, Georg Everhard. Herbarium Amboinense. Amsterdam, The Hague, Utrecht. Volume V, 1747.

Volume V. p. 416. Two varieties are described, both apparently used in cookery.

1790—Loureiro, Joannis de. Flora Cochinchinensis. Ulyssipone, 1790.

Volume I. p. 130. Described as growing in the fields and gardens of Cochinchina.

1832—Roxburgh, William. Flora Indica. Serampore, 1832.

Volume I. p. 565. *S. Lycopersicum*. "Although this is now very common in India, I suspect it is as little a native as the common potatoe, which is now very generally cultivated over India, even by the natives for their own use."

1837—Blanco, Manuel. Flora de Filipinas. Manila, 1837.

p. 135. "The natives make immense use of the fruit [of the tomato] which they use in almost all their dishes. With their leaves, they dye cotton cloth a dirty green."

The 1845 edition of this work carries the same reference (p. 96).

1865—Birdwood, G. C. M. Catalogue of the Vegetable Productions of the Presidency of Bombay. Bombay, 1865.

p. 173. *Lycopersicon esculentum*. The fruit is reported as eaten as a salad and sauce. It is described as cultivated widely.

1893—Duthie, J. F., and Fuller, J. B. Field and Garden Crops of the North-western Provinces and Oudh. Roorkee, 1893.

Part III. p. 30. Tomato or love apple. "This vegetable is coming more into favour with natives as an article of food on account of its acid taste."

1916—Bamber, C. J. Plants of the Punjab. Lahore, 1916.

p. 403. "This South American plant is widely cultivated . . ."

- 1932—Ochse, J. J. Vegetables of the Dutch East Indies. Buitenzorg, Java, 1932. pp. 675–678. Cultivated everywhere in Java. Young and old fruits are eaten as *lalab*, in *sambēlan* (*sambēl gorēng*) or in *sayoor lodēh*. The author expressed doubt that the young leaves are eaten as *sepan* with rice as is reported by Hasskarl.
- 1939—Kanjilal, U. N., *et al.* Flora of Assam. Calcutta, 1939.

Volume III. p. 572. Cultivated throughout the province . . . Flowers and fruits throughout the year.

UNITED STATES

This designation includes the United States and the European colonies which have occupied its continental limits.

- 1710—Salmon, William. Botanologia. The English Herbal or, History of Plants. London, 1710.

pp. 29–30. (See Great Britain, 1710. Salmon.)

The reference to the presence of the tomato in Carolina in this work antedates by fifty-six years the next mention of the tomato within what was to become a part of the United States. This is apparently an eye-witness report; no hint is given as to the use which was being made of this plant or its fruit.

- 1766—Bartram, John. "Diary of the Journey through the Carolinas, Georgia and Florida from July 1765 to April 10, 1766." Transactions of the American Philosophical Society. New Series. Volume XXXIII. Part I. 1942.

p. 53 [dated 1766]. "ye 2 nights frost [,] with some ice [,] of ye 4 & 5 of december [,] ye Govenour tould me was harder a Augustine than any they had before crismas last year [,] it killed ye pumpkin vines & many of ye leaves of ye carolina peas but did not hurt ye tomatiss [.]"

This mention of the "tomatis" antedates by nearly twenty years the next mention of the plant within what was to become a part of the United States.

From the context it appears that the tomatoes were being used as food plants.

- 1779—Pieters, A. J. "Seed Selling, Seed Growing, and Seed Testing." Yearbook of the United States Department of Agriculture, 1899. Washington, 1900.

p. 568. "In New Orleans they were used in catsup as early as 1779, but in the English colonies tomatoes were planted only as ornament, under the name of 'Love apples'."

This reference is not documented.

- 1782—Jefferson, Thomas. Notes on the State of Virginia. Baltimore, 1800.

p. 41. "The gardens yield musk-melons, water-melons, tomatoes, okra . . ."

The same quotation is reported to appear in the 1782 edition of the work. (Jefferson's *Garden Book*. p. 648—see 1809 below. Jefferson.)

1784—Boyd, James. *A History of the Pennsylvania Horticultural Society, 1827–1927*. Philadelphia, 1929.

pp. 22–23. "For several years the Landreths [David Landreth Seed Co.] were the only florists to introduce vegetables, fruits and flowers to the citizens of Philadelphia. They labored under difficulties as they had to make all their sales from a garden stall, by the side of the old Court House. Later, other gardeners, florists, and seeds men took up this work as the desire for rare products increased. Tomatoes, ochra, and artichokes were first demanded by the French immigrants and there was little sale for them to others. Afterwards, cauliflower, head lettuce, egg plant, oyster plant, cantaloupes, rhubarb and sweet corn were introduced."

This reference comes from a section of the work dated 1784.

1785—Varlo, C. *A New System of Husbandry*. Philadelphia, 1785.

Volume II. p. 291. In an article entitled "The Gardeners Calendar, for Work to be done round the Year in the Kitchen Garden," tomatoes are listed under "March."

1792—Imaly, G. *A Topographical Description of the Western Territory of North America*. London, 1792.

p. 88. Tomatoes are not listed in a rather long list of culinary plants and vegetables grown in the upper settlements on the Ohio.

1794—M'Mahon, Bernard. *A Catalogue of Garden, Grass, Herb, Flower, Tree & Shrub-Seeds, Flower-Roots &c, &c*. Sold by Bernard M'Mahon, Seedsman.

A single broadside sheet. Under Seeds of Annual Flowers, are listed: Tomatoes, or Love Apple. Mr. Edward C. Vick of Newark, New Jersey, who discovered this early catalogue, first dated it at 1804. A thirty-page catalogue of M'Mahon's issued in 1804 was subsequently discovered and this broadside sheet was then dated at eight to ten years earlier, 1796–1794.

1798 and 1802—Manning, Robert, Jr. *History of the Massachusetts Horticultural Society, 1829–1878*. Boston, 1880.

p. 40. "The tomato was introduced into Salem about 1802, by Michele Felice Corne, an Italian painter; but he found it difficult to persuade people even to taste the fruit. It is said to have been introduced into Philadelphia by a French refugee from St. Domingo, in 1798. It was used as an article of food in New Orleans in 1812, but was not sold in the markets of Philadelphia until 1829. It did not come into general use in the North until some years later after the last-named date."

p. 248. A premium is offered in 1839 by the Massachusetts Horticultural Society for the first time for the best tomatoes.

p. 344. "As perhaps the most striking instance of improvement we may mention the tomato, now universally used, but in 1845 comparatively unknown."

1802—Anonymous note. *The Cultivator*. New Series. Volume IX. Albany, N. Y., 1852.

p. 381. "It is said that this fruit, which is of very modern introduction into our gardens, has been in long use by the French and Italians—and that among the old French settlers, on the banks of the Kaskaskia, in Illinois, it has been cultivated for more than fifty years."

1803—Gleanings from the Most Celebrated Books on Husbandry, Gardening and Rural Affairs. Philadelphia, 1803.

p. 194. Love-apple (*S. Lycopersicum*). The culture of this plant is described. Two varieties, one red and the other yellow, are listed. Under uses: "The fruit in medicine; also for sauces, soups, and pickling."

This edition is identical to a London edition, also of 1803.

1804—Gardiner, John, and Hepburn, David. The American Gardener. Washington, 1804.

p. 27. "Sow love apples . . . The fruit is used for soups and pickles."

1804—Willdenow, C. L. Anleitung zum Selbststudium der Botanik. Berlin, 1804.

p. 167. (See Central Europe, 1804. Willdenow.)

1806—M'Mahon, Bernard. The American Gardener's Calendar. Philadelphia, 1806.

p. 200. "The different varieties of the Capsicums, Tomatoes, and Eggplants . . . are in much estimation for culinary purposes . . ."

p. 319. "The *Solanum Lycopersicum*, Tomato, or Love-apple is much cultivated for its fruit, in soups and sauces to which it imparts an agreeable acid flavour; and is also stewed and dressed in various ways, and very much admired."

1809—Hosack, David. A Catalogue of Plants contained in the Botanic Garden at Elgin, New York, 1809.

p. 26. *Solanum lycopersicum* is listed.

1809—Squibb, Robert. Gardeners Calendar for North Carolina, South Carolina and Georgia. Charleston, 1809.

p. 52. Sow tomatoes.

p. 76. Transplant.

p. 90. Stake, etc.

The same reference appears in the 1827 edition of this work with different pagination (pp. 59, 83, 98).

1809-1814—Jefferson, Thomas. Thomas Jefferson's Garden Book. 1766-1824. Annotated by Edwin M. Betts. Philadelphia, 1944.

p. 391. Tomatas from G. Divers are noted in the Garden Kalendar for 1809.

p. 403. In a letter from General John Mason to Jefferson from Analoaton on Jan. 22, 1809: "J. Mason presents his respects and with very great pleasure sends him the garden seeds asked in his note of the other day, in addition to which he begs his acceptance of the few of the *Buda Kale*—and excellent variety of cantaloup—Spanish tomata."

p. 470. Tomatas are listed as "come to the table" on August 14, 1812.

p. 506. Although his seed stocks are scanty he sends Randolph several varieties, including tomatas.

- p. 536. Reports that tomatas were killed by frost on May 9, 1815.
- p. 613. A letter from Mexico dated March 21, 1824, encloses tomatas to care of W. [Mc] Andrews for Mr. Jefferson.
- p. 639. In "A Statement of the Vegetable Market during a period of 8 years wherein the earliest and latest appearance of each article within the whole 8 years is noted," the dates listed for tomatoes are July 16 and November 17.
- Reference is made to the tomato in several lists and gardening calendars in addition to those mentioned above. The index to this work contains a full listing of these. (See 1845, Anonymous. "The Tomato," below.)
- 1811—Hosack, David. Hortus Elginensis, or a Catalogue of Plants indigenous and exotic, cultivated in the Elgin Botanic Garden. Second edition. New York, 1811.
- p. 53. Lists *Solanum Lycopersicum* as a culinary vegetable. (See 1809 above. Hosack.)
- 1812—(See 1798 above. Manning.)
- 1819—The Practical American Gardener, by an old Gardener. Baltimore, 1819.
- pp. 57, 71, 87, 94, and 101. Tomatoes are listed with directions for their handling at various times of the year. The plant is listed in the table of contents of this work under the heading, "Kitchen Garden Esculent Plants, &c."
- 1819—M'Murtrie, R. Sketches of Louisville. Louisville, 1819.
- p. 226. In *Florula Louivillensis*. *Solanum lycopersicon* is listed as a cultivated plant.
- 1820—Anonymous note: From the Practical American Gardener for the Month of May. American Farmer. Volume I. Baltimore, 1820.
- p. 36. Directions are given for sowing tomatoes. (See 1819 above. The Practical American Gardener.)
- 1820—Helfer, Harold. "Love Apple." The Farm Quarterly. Volume VII. Number 1. Spring, 1952.
- p. 49. "One of the unsung heroes of our country was Robert Gibbon Johnson, a great man who made a lasting and profound contribution to our society, and was then forgotten. Hardly any one ever heard of this man, much less of his brave act on the courthouse steps at Salem, N. J., on a hot August day in 1820 . . .
- " . . . his claim to fame rests on neither his wealth nor the honors that were thrust upon him.
- "Robert Gibbon Johnson deserves immortality because he ate a tomato."
- The article implies that through Johnson's public consumption of the tomato its popularity was greatly enhanced.
- Helfer also reports that the name "Love Apple" is applied because a "red, ripe tomato was sometimes presented by a shy swain to his sweetheart as a token of his love."

1820-1875—Interview with Mrs. Minnie Du Bose Horner (née Winans).

Mrs. Horner is an alert, intelligent, and charming southern lady of 93. She was born on a plantation near Shreveport, Louisiana, on May 29, 1859. Her memory, however, includes events, by virtue of stories told her by her grandfather, back to at least 1820. As she recalls, her grandfather told her that when he was a boy (about 1820) in Virginia, people thought tomatoes were poisonous, and used the ripe fruit as mantle decorations. She herself remembers an older sister eating tomatoes right off the vine with a little salt. On one occasion, the sister ate so many in this fashion that she made herself ill. This event is approximately dated 1864.

In the period around 1869, Mrs. Horner was sent to a girls school at Mansfield, Louisiana. She recalls how she experienced a sudden craving for tomatoes during a minor illness in the early winter. A stray tomato was found on the frost-bitten vines and brought in for her to eat.

The family moved to Columbia, Missouri, in 1873. There Mrs. Horner remembers a keen competition between her grandfather and a neighbor to see who could raise the earliest tomatoes. At this time the fresh fruit was commonly used. Before satisfactory canning techniques were developed, the tomato was frequently made into a sweet preserve or pickle.

1822—Anonymous note. *American Farmer*. Volume IV. Baltimore, 1822.

p. 40. A farm wife describes her trouble with bed bugs, and how she got rid of them. It seems that while she was walking in the garden she accidentally touched a tomato vine which was particularly nauseous in smell to her. It occurred to her that the smell might also be nauseous to the bed bugs. She rubbed the bedstead with a tomato vine, and presto! No bed bugs.

1822—Anonymous recipe. *American Farmer*. Volume IV. Baltimore, 1822.

p. 208. A recipe is given for the preservation of tomatoes for the winter. It involves cooking them with salt, pepper, ginger, and garlic and then bottling them.

1823—Anonymous recipe. *American Farmer*. Volume V. Baltimore, 1823.

p. 215. A recipe for tomato catsup is printed.

1825—Sturtevant, E. Lewis. "Kitchen Garden Esculents of American Origin III." *American Naturalist*, 1885.

p. 668. Without documentation, Sturtevant says that the tomato was grown in western New York for the first time in 1825 from Virginia seed. He also reports that "Mr. T. S. Gold, secretary of the Connecticut Board of Agriculture, writes me that 'we raised our own tomatoes about 1832, only as a curiosity, made no use of them though we had heard that the French ate them. They were called love apples'."

This article contains several other partially documented references to the early use of the tomato in the United States. These incomplete references are included in the body of this bibliography. (See also 1919 below. Sturtevant.)

1826—Anonymous note. American Farmer. Volume VIII. Baltimore, 1826.

p. 279. Love Apples. "An ingenious mode has lately been discovered in Spain, of preserving for an indefinite time, the perfume and other qualities of the tomato, and of conveying it to great distances in a small compass. This process consists in pulverizing the fruit after having dried it in the sun and in an oven. To preserve the powder, all that is necessary is not to expose it to the air."

1826—Anonymous note. American Farmer. Volume VIII. Baltimore, 1826.

p. 261. "A gentleman in New London, near Lynchburg, has raised a tomato 2 feet and 3 inches in circumference."

1826—Darlington, William. Flora Cestrica. West-Chester, Pennsylvania, 1826.

p. 117. *S. Lycopersicum*. "We have a variety with the fruit smaller, and not torulose. This plant is cultivated for the sake of the mature fruit which is of a sprightly acid taste,—and much admired by many as a sauce, with meats."

1827—Cousin Tabitha. "Recipe for Tomato Ketchup." American Farmer. Baltimore, 1827.

p. 191. "... To my taste this is superior to any West India ketchup that I have ever met with, and is withal an excellent remedy for dyspepsia."

1828—Anonymous recipes. The Southern Agriculturist. Volume I. Charleston, 1828.

p. 143. Two recipes are given: (a) Tomato sauce for cold meat, and (b) Potted Tomatoes.

1828–1838—White, William N. Gardening for the South. New York, 1868.

p. 312. Quotes Robert Buist as writing, "that as an esculent plant in 1828–29, the tomato was almost detested, yet in ten years more every variety of pill and panacea was 'extract of tomato'."

1829—Anonymous. "On raising tomatoes from cuttings" (originally from the Southern Agriculturist). American Farmer. Volume XI. Baltimore, 1829.

pp. 164–65. The article describes the method of raising tomatoes from cuttings and describes a technique for ripening which yields tomatoes for Christmas.

1829—(See 1789 above. Manning.)

1830—Blake, Eli W. "Acid in Tomatos." The American Journal of Science and Arts. Volume XVII. New Haven, 1830.

p. 115. "I would suggest to your sir . . . the idea of examining the acid contained in Tomatos. I have observed that it acts powerfully on tin, which I believe is not common with the vegetable acids. I have observed this fruit has the remarkable property of imparting a beautiful orange color to animal oils."

1831—Anonymous. "On Plantation Gardens and the Culture of Vegetables." *The Southern Agriculturist*. Volume IV. Charleston, 1831.

p. 81. "So general a favorite is the tomato and so eagerly sought after and desired on our table, that we may be excused for diverging a little from our subject, whilst we give a process by which they can be had throughout the winter." He then proceeds to describe a technique by which the tomato is dried in slabs and pieces broken off as needed throughout the winter.

1831—Anonymous. "Letter to Mr. Fessenden." *The Southern Agriculturist*. Volume IV. Charleston, 1831.

p. 503. "As tomatoes have, at last, become common in our market, I send you a recipe for preserving them during winter. Besides the numerous modes of preparing this delicious vegetable for the table, it may be stewed, etc." A recipe for the preservation of tomatoes follows.

1832—Anonymous note. *American Farmer*. Volume XIV. Baltimore, 1832.

p. 222. The article quotes Gerarde on tomatoes as a food, (. . . they yield very little nourishment to the body and the same naught and corrupt.—see Great Britain, 1597. Gerarde), and continues: "His [Gerarde's] opinion of the tomato as an article of food might find advocates in the present day, among those who have only tasted, but who have not given them a fair trial. To most persons the flavor is disagreeable at first which a little use entirely counteracts or removes. The culture of this fine fruit ought to be more extensively introduced amongst our countrymen."

1832—Anonymous recipe. (Originally from the *Southern Planter and Family Lyceum*.) *American Farmer*. Volume XIV. Baltimore, 1832.

p. 286. A recipe for Tomato preserves "which tastes so much like peach preserves it can serve as a substitute."

1832—Anonymous letter. (Originally from the *Southern Agriculturist*.) *American Farmer*. Volume XIV. Baltimore, 1832.

p. 350. The writer sends in some seeds of the "Mississippi tomato" noting that "they are found bordering on the Mississippi swamp, spreading an unusual length, forming a beautiful vine, ornamental; and the seed growing in clusters resembling grapes."

The letter is dated Buffalo, Sept. 10, 1832.

1832—(See 1825, Sturtevant, above.)

1833—Bridgeman, T. *The Young Gardener's Assistant*. N. Y., 1833.

p. 69. Tomato. "The tomato or Love Apple is much cultivated for its fruit in soups and sauces to which it imparts an agreeable acid flavour; and is also stewed and dressed in various ways, and very much admired."

1833—Anonymous note. *American Farmer*. Volume XV. Baltimore, 1833.

p. 121. It is reported in the June 28, 1833 issue, that "ripe tomatoes were sold in Market on Wednesday, 19th instant, by Mr. Frieze's gardener" for fifty cents a dozen.

1833—Anonymous note (originally from the Genesee Farmer). *American Farmer*. Volume XV. Baltimore, 1833.

p. 407. A method for the raising of early tomatoes is described. The author adds, "In this way I never fail to have abundance of this wholesome and delicious vegetable."

1834-1854—Brown, D. J. "The Tomato." Report of the U. S. Commissioner of Patents for the Year 1854—Agriculture. Washington, 1854.

p. 385. "The tomato, until within the last twenty years, was almost wholly unknown in this country as an esculent vegetable, and only to be found in borders and flower gardens, for ornament and curiosity, under the name of 'Love apple.' Since its introduction to the uses of the table, and the discovery of its exceedingly wholesome properties, it has been rapidly gaining favor, and is now one of the most common of all culinary vegetables. It is extensively grown near the large markets, where its high price early in the season is a great inducement to gardeners to undertake to produce an early crop."

Following this quoted material there is a description of the method of cultivation and of winter ripening, and a list of varieties with their particular uses. Some are noted as being especially good for pickling or for preserves.

1834—(See 1798 above. Manning.)

1835—Anonymous. "The Tomato." *The Cultivator*. Volume II. Albany, N. Y., 1838 (a republication of the 1835 edition).

p. 94. "Dr. Benner, a medical professor in one of the western colleges, considers the tomato as an invaluable article of diet. He ascribes to it high medicinal properties and declares, '1st. That it is one of the most powerful deobstruents (i.e. removing obstructions; having the power to clear or open the natural ducts of the fluids and secretions of the body; resolving vicidities; aperient) of the materia medica.

"2nd. That a chemical extract will probably soon be obtained from it which will altogether supersede the use of calomel in the cure of diseases.

"3rd. That he had successfully treated serious diarrhoea, with the article alone.

"4th. That when used as an article of diet it is almost a sovereign for dyspepsia, or indigestion.

"5th. That persons moving from east or north, to the west or south, should by all means make use of it as an aliment as it would in that event save them from the danger attendant upon those violent bilious attacks which almost all unacclimated persons are liable to.

"6th. That the citizens in general should make use of it, whether raw or cooked or in the form of a catsup, with their daily food as it is the most healthy article of the *Materia Alimentaria*, &c., &c!"

"Without intending to indorse all of the professor's conclusions, we know enough of this vegetable from experience to recommend it as a grateful vegetable, and salutary to health in the summer months.

"It is extensively used in the south and southwest as an article of diet. It is easily cultivated, and readily prepared for the table in various forms, requiring merely a seasoning of salt and pepper . . ."

1835—Maine Farmer. August 21, 1835.

It is reported that in one of the western colleges about this time, a Dr. Benner refers to the tomato or "Jerusalem apple" as being found in abundance in the markets. (See 1825 above. Sturtevant.)

1835—Maine Farmer. September 11, 1835.

In the *New York Farmer* of this period, one person is mentioned as having

planted a large number of plants for the purpose of maturing fruit for the making of sauce. (See 1825 above. Sturtevant.)

1835—Maine Farmer. October 16, 1835.

An editorial on the tomato says that it is cultivated in gardens in Maine and is "a useful article of diet and should be found on everyman's table." (See 1825. Sturtevant, above.)

1835—Corbett, L. C.; Gould, H. P.; *et al.* "Fruit and Vegetable Productions."

United States Department of Agriculture Yearbook, 1925. Washington, 1926.

p. 415. "There are abundant evidences that the tomato or 'love apple,' as it is called, was considered poisonous by the majority of the American people prior to 1835. Elizabeth Clark, who was born in Trenton, N. J., in 1833, related during her lifetime how when as a child she gathered and ate the 'love apple,' but when caught in the act she was rushed to the doctor with the fear that she had been poisoned and would probably not survive."

1837—Darlington, William. *Flora Cestrica*. West-Chester, Pennsylvania, 1837.

p. 137. *S. Lycopersicum*. "This is cultivated for its fruit,—which is much esteemed by many persons as a sauce or condiment, and is, of late years, coming into very general use."

1837—Anonymous. "The Tomato." *The Cultivator*. Volume IV. Albany, N. Y., 1837—38.

p. 62. "We are receiving new evidence of the utility of this grateful garden vegetable in preserving health, and in curing indigestion and diseases of the liver and lungs. A writer in the *Farmer's Register* says it has been tried by several persons to his knowledge with decided success. They were afflicted, says he, with a chronic cough, the primary cause of which in one case was supposed to be a diseased liver—in another a diseased lung. It mitigates, and sometimes effectually checks a fit of coughing. It was used in a dried state, with a little sugar mixed with it, to render it more agreeable to the taste. The writer expresses a conviction that, if freely used in July, August, and September, it would prove a complete antidote to bilious fever. [Then follows a method for cultivating the tomato and drying it in the sun.] We consider the tomato and rhubarb the most healthy products of the garden.

"Professor Rafinesque says of the vegetable, 'It is everywhere deemed a very healthy vegetable, and an invaluable article for food.'

"Professor Dickson writes, 'I think it more wholesome than any other acid sauce.'

"Professor Dungilson says—'It may be looked upon as one of the most wholesome and valuable esculents that belong to the vegetable kingdom.'"

1838—Anonymous note. *The Cultivator*. Volume V. Albany, N. Y., 1838—39.

p. 184. "There has been, of late, so much said in commendation of this vegetable as promotive of health, that we need not recommend its culture. It is a grateful and healthy vegetable in many ways to those who are accustomed to its use . . . They are an excellent ingredient in soups, make a good catsup, stewed in their own liquor they are a fine sauce for meats; they may be dried or pickled; and they are made the basis of a medicine which, if we are to credit the declarations of the venders, is an infallible cure for most all sorts of diseases which man is heir to."

1838—Lelievre, J. F. *Nouveau Jardinier de la Louisiane*. Nouvelle-Orleans, 1838.

p. 109. *Tomate (Pomme d'Amour)*. "Many species are known all of which are used in cooking and are equally good.

"One can use them to decorate a partition, a wall or the lower part of a garden house, where they produce a nice enough effect through the tender green of their leaves and the rose of the fruit standing out [against them]."

1839—Farnham, Thomas J. "Travels in the Great Western Prairies, the Anahuac and Rocky Mountains and in the Oregon Territory." Travels in the Far Northwest. Edited by Reuben Gold Thwaites. Cleveland, Ohio, 1906.

Volume I. p. 334. Tomatoes are reported among the crops being grown in September, 1839, at the Whitman Mission near Walla Walla.

p. 337. "The breakfast being over, the doctor invited me to a stroll over his premises. The garden was first examined; its location on the curving bank of the Wallawalla; the apple trees, growing thriftily on its western border; the beautiful tomatos and other vegetables burdening the grounds."

1839—Anonymous. "How to Pickle Tomatoes." The Cultivator. Volume VI. Albany, N. Y., 1839-40.

p. 134. "Daily use of the tomato: cut up with salt, vinegar and pepper (as you do cucumbers) and eat away as fast as you can."

Recipes for pickling and stewing tomatoes are also printed.

1839—Anonymous. "How to preserve Tomatoes for the Winter." The Cultivator. Volume VI. Albany, N. Y., 1839-40.

p. 183. "Among other improvements in horticulture, I have been gratified to observe the increased cultivation of the tomato. Believing this to be a most healthy vegetable, I send you an account of the manner in which universally in Asia Minor, they are preserved for use during the winter . . . [Then follows a method for preserving fruit involving treatment with salt, running through a collander, and sun drying in shallow dishes. The dried material of jelly-like consistence is stored in jars.]

"A tablespoonful of this tomato jelly is enough to impart a relish to a dish of pilaf, that is, rice cooked with meat or butter, or soup, for a large family."

1839—(See 1798 above. Manning.)

1840—Dewey, Chester. Report on the Herbaceous Flowering Plants of Massachusetts. Cambridge, 1840.

p. 166. *Solanum lycopersicum* L. Tomato. "The specific name is from the Greek for *wolf* and *peach*, from the beauty of the fruit and its deceitful value.—Loudon. The estimate of the fruit seems to be much changed. It has for some time been 'one of the most important articles used in Italian cookery,' and in England and this country its cultivation has greatly increased, and it is now a very agreeable and important vegetable. Its peculiar acid seems to be most grateful to the stomach, and in many instances has averted the evils of dyspepsia and kindred affections. A professed extract of the fruit has been prepared for use, when the fruit cannot be obtained. The danger of imposition upon the public in all such cases need only be adverted to. The fruit, plucked before it is ripe, is often pickled. The preservation of the fruit in some way, by which its properties should not be essentially altered, is a great desideratum for dyspeptics . . ."

1841—Russell, J. W. "On the Culture of the Tomato and Egg Plant." Magazine of Horticulture. Volume VII. Boston, New York, 1841.

p. 97. "The Tomato (*Solanum lycopersicum*) is of the same family of plants as the potato (*Solanum tuberosum*); the French and Italians, particularly the latter, think as much of a field of tomatos as a New England farmer does of a choice field of potatoes.

"Tomatoes are so well known, that the fruit, when ripe, has become almost an indispensable dish through the summer months, on every table. The modes of cooking it are various according to the taste and fancy of individuals, and it would, I conceive, be altogether unnecessary to describe them."

1841—Anonymous note. *The Cultivator*. Volume VIII. Albany, N. Y., 1841.

p. 76. "The tomato has within a few years acquired much celebrity as a garden vegetable, and to most palates, it is as delicious as it is certainly conducive to health . . . Those who have not hitherto cultivated this plant will do well to introduce it into their gardens."

1842—Hooker, Edward James. *The Practical Farmer, Gardener and Housewife*. Cincinnati, Ohio, 1842.

p. 493. The author says that the tomato has recently been found a sovereign remedy for dyspepsia and for persons with too much bile. He notes that the discovery was made "last summer" and has greatly increased consumption.

According to this report, you can't lose with this vegetable. What can't be sold raw can be sold as catsup. Hooker reports that "one gentleman last year cleared \$1,000 by rearing this article on a small farm near the city."

The author predicts that in 1843 there will be four times as many users of the fruit as there were in 1842. Recipes for Tomato Sauce, Omelet, etc. are listed.

He concludes, "The tomato has become a great favorite, sliced and seasoned as we do the cucumber, and has the advantage of being quite wholesome."

1842—Anonymous. "The Kitchen Garden." *The American Agriculturist*. Volume I. New York, 1842.

p. 91. "There are but few who relish the tomato at the first taste; and few who are not extremely fond of it when properly cooked and they become accustomed to it. It is considered by physicians and others acquainted with its effects, not only a very delicious, but a very wholesome vegetable; indeed, some will give a decided preference of a dish of tomato sauce or a tomato pie when properly prepared to anything of the kind in the vegetable kingdom.

"There is no vegetable more easily raised and none better pay the cultivator where they are generally known. They are used in various ways, either raw, with sugar, or stewed for sauce or in fricasses and soups for catsup or gravy, for meat and for pies, or preserves, as well as for pickles and sweet meats."

1842—Anonymous. "The Tomato." *The Cultivator*. Volume IX. Albany, N. Y., 1842.

p. 165. "The *Wayne Sentinel*, published at Palmyra in this state, informs us that ripe tomatoes grown upon a last year's plant, which as an experiment had been preserved through the winter in a box and set out in the garden in May, were picked by one of our citizens early in August. This is a simple and cheap, if not new mode, of obtaining an early supply of this valuable and delicious vegetable and will no doubt be enlarged upon hereafter."

1842—Anonymous. "The Tomato and its Uses." *The Cultivator*. Volume IX. Albany, N. Y., 1842.

p. 167. "Every body cultivates the tomato and every one who has not deliberately made up his mind to be ranked among the nobodies has learned to eat it. There is a great deal of fashion in this, it must be confessed, but it is not often that fashion is active in forwarding so good a work; for if the opinions of numerous M.D.'s of great celebrity, are to be allowed of any weight there are a few things more conducive to health than a liberal use of tomatoes. The fruit has long been extensively used in Italy and the South of France, and within a few years, its cultivation as an article of luxury, if not of necessity, has spread over the greater part of Europe and the United States. The fruit is the best in a warm climate where it has an acidity and briskness unknown in a colder one. In our southern states, the fruit is finer and the flavour richer than in the northern ones; still, in these last, abundance of tomatoes of excellent quality are grown . . .

"Frequent inquiries are made by those who have but lately commenced their cultivation as to the best modes of cooking or preserving them . . ." [Then follows a long list of recipes including: tomato catsup; sliced tomatoes with salt, vinegar and pepper or with sugar; tomato soy; tomato omelet; tomato as a relish for beefsteak; stewed tomatoes; tomato preserves; tomato pickles; tomato figs; tomatoes for winter.]

1843—Burr, Fearing, Jr. *Field and Garden Vegetables of America*. Boston, 1862.

p. 639. "In this country its [the tomato's] cultivation and use may be said to have increased fourfold within the last twenty years; and it is now so universally relished, that it is furnished to the table in one form or the other, through every season of the year. To a majority of tastes, its flavor is not at first particularly agreeable but, by those accustomed to its use, it is esteemed one of the best as it is reputed to be one of the most healthful of all garden vegetables."

1844—Anonymous. "Garden Vegetables." *The Cultivator*. New Series. Volume I. Albany, N. Y., 1844.

p. 100. "The Tomato, though now much more common than formerly, is still not to be found in many farmer's gardens, where it should be certainly, if the mandates of imperious fashion are in any degree to be heeded. The tomato, though found in its greatest perfection in southern latitudes, can with a little attention be grown in most of our gardens and furnish for months a wholesome and, to many, a most agreeable article of food. Few like the tomato at first, but . . . soon become not only reconciled to it, but are much pleased with it . . ."

"There are several varieties of the tomato, but the large red for the table or preserving, and the cherry tomato for pickling are perhaps the best. They are used in various ways, eaten in vinegar as cucumbers, made into soups, into toasts, baked in pies, but perhaps the greatest use is in tomato sauce which is highly esteemed."

"There can be no doubt that our farmers might, at a little expense, greatly enlarge their list of garden esculents; and in doing so materially decrease their annual expenses, while they are at the same time adding to their comforts."

1845—(See 1798 above. Manning.)

1845—Beecher, —. "Cooking Tomatoes." *The Cultivator*. New Series. Volume II. Albany, N. Y., 1845.

p. 321. "Mr. Beecher of the *Indiana Farmer* speaks with the enthusiasm of an epicure on the subject of tomatoes. He says that whoever does not love them, 'is an object of pity.' There's no accounting for taste. The editor of the *Boston Courier*, for instance, repudiates Mr. Beecher's taste and compares tomatoes to 'rotten potatoe-balls'."

1845—Anonymous. "The Tomato." *The American Agriculturist*. Volume V. New York, 1846.

p. 282. "Thomas Jefferson Randolph, the protégé of Jefferson, in an address before the Agricultural Society of Albemarle County, Virginia, delivered some time ago, stated that Mr. Jefferson could recollect when the tomato was cultivated as an ornament to the flower-garden and deemed poisonous." (See 1809 above. Jefferson.)

1845—Anonymous note. *The American Agriculturist*. Volume V. New York, 1846.

p. 303. "Mr. Meigs read from the 'Annals of the Royal Horticultural Society of Paris' an account of a successful experiment in grafting a stem of the tomato

upon the stalk of a potato, by which a crop of tomatoes was raised in the air and one of potatoes in the earth."

1847—Johnson, George W. *A Dictionary of Modern Gardening*. Edited by David Landreth. Philadelphia, 1847.

p. 590. "This plant is a native of South America, and perhaps of the West Indies; thence introduced into this country. But a few years since, it was scarcely known as an esculent—now it is in very general use."

1848—Munson, W. M. "Tomato Notes." West Virginia Agricultural Experiment Station, Morgantown, W. Va. Bulletin 117. June 1, 1908.

p. 251. "The credit of introducing canned tomatoes as an article of trade is due to Mr. Harrison W. Crosby, who made his first venture in 1848, while steward of Lafayette College, Easton, Pennsylvania. There was a ready demand for the goods, and with increased supply and improved machinery, the cost has been reduced from 50 cents per can in 1848 to 7 cents at the present time."

1850—Goodrich, C. "Raising Tomatoes in Vermont." *Magazine of Horticulture*. Volume XVI. Boston, 1850.

p. 330. "I noticed in the *Horticulturist* for June, among the 'Answers to correspondents' one to a 'Vermont subscriber' in which the editor says, 'Your season is not quite long enough for the okra or tomato.' If he will visit us in this 'Northern part of Vermont,' in August, September, October, or November, we will engage to give him a full supply of tomatoes; and will CONTRACT to freight one of our *lake craft* with them and send him at the price of potatoes. No vegetable is here more easily grown or so freely given away. They are raised with no trouble but thinning and cultivating the plants, which grow abundantly from self sown seeds . . . Yours, C. Goodrich, Burlington, Vermont. May, 1850."

1851—Neill, Patrick. *The Fruit, Flower and Kitchen Garden*. Adapted to the U. S. from the 4th Edition. Philadelphia, 1851.

p. 236. Reports that the tomato is of immense consumption in the South and Middle states, and is the object of intensive field cultivation in the neighborhood of Philadelphia.

1853—Anonymous. "Notizen." *Gartenflora*. Volume II. Erlangen, 1853.

pp. 248-249. (See Central Europe, 1853. Anonymous.)

1862—Boswell, Victor R. "Improvement and Genetics of Tomatoes, Peppers, and Eggplant." United States Department of Agriculture Yearbook, 1937. Washington, 1937.

p. 179. A tomato variety by the name of "Fiji Island" was introduced into the United States in 1862. (See South Pacific, 1838. Wilkes.)

1919—Sturtevant, E. Lewis. *Sturtevant's Notes on Edible Plants*. Edited by U. P. Hedrick. Report of the New York Agricultural Experiment Station for the Year 1919. II. Albany, 1919.

pp. 343-348. Sturtevant presents a detailed study on the history of the

tomato, etc. Most, if not all, of the references quoted by Sturtevant in the above work, are included, if pertinent, in this bibliography.

Earlier and only slightly different versions of this same article appeared in 1885, Sturtevant, above, and in the *Report of the Maryland Agricultural Experiment Station*, 1889 (pp. 18-25).

SOUTH PACIFIC

1838-1842—Wilkes, C. *Narrative of the U. S. Exploring Expedition*. Philadelphia, 1845.

Volume III. p. 309. "The Feejee tomato (*Solanum*) in its green state was first seen at Tavea. . . . The tomato, already spoken of, was found here in its ripe state. It is believed to be a perennial plant. The fruit is the size of an orange, and of an agreeable flavour; it has been grown and ripened in Philadelphia, and I am in hope will in a short time be acclimated in the United States, where it will be a great acquisition."

p. 335. "The new species of tomato (*Solanum*) of which mention has already been made, may be almost classed with the fruits; it is cultivated by the natives on account of its fruit, which is round, smooth, and about the size of a large peach; when ripe, its colour is yellow; its taste was by some thought to have a strawberry flavour. We have made every endeavor to introduce the plant into the United States by sending home seeds, some few of which have fallen into good hands, and been taken care of; but I regretted to find the greatest part had been distributed to those who had not taken any care in its cultivation. Fruit from the seeds had, however, been produced in Philadelphia. The plant will, no doubt, succeed in the southern section of the Union. It is supposed to be biennial. There were two smaller varieties of the same species, which the natives eat, and which are about the size of an egg." (See U. S., 1862. Boswell.)

1839—Anonymous. "Foreign Notices." *Gardener's Magazine*. Volume XV. London, 1839.

p. 475. Tomatoes are listed among the vegetables for which prizes were awarded at a show of the Sydney Floral and Horticultural Society. The account is reprinted from the *Sydney Monitor* of February 15, 1839.

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